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BRIEFLY TOLD.

THE GAS RATE AT TOLEDO, OHIO.—For many months the officials of the city of Toledo, Ohio, have been to all intents and purposes engaged in an attempt to put the Toledo Gas Light and Coke Company outside the list of manufacturing corporations that pay returns to their shareholders in the shape of dividends, and were it not for the firm stand taken by President Young and Superintendent Faben it is possible that the political harpies would have succeeded. At an early stage of the contest the reformers, who so dearly love "an issue," and who are anxious for the exploitation thereof only as a means of bringing grist to their mill, sounded the time-honored cry of cheaper gas, and actually had the effrontery to claim that the Company could well afford to supply gas to the residents at the uniform charge of 75 cents per 1,000 cubic feet. Naturally enough this proposition pleased the average Toledo man immensely, and formed an issue with a halo so bright that the politicians were amazingly self-satisfied with their astuteness. The trouble, however, was to cause the sheep that it was proposed to lead to the slaughter to accept its doom without unnecessary bleating; but as the sheep was up to knowing that it could die only once, and as the penchant for roaming indefinitely in its pasturing ground was still strong within it, it protested in a tone that was by far nearer to a bellowing than to a bleating. In the course of the struggle some of those in the city inclined to fair play thought that the Company was entitled to a hearing, and finally the movement to cut the rate summarily and to an inordinately low figure was stayed. As said before, through many long months this discussion has dragged, and while it is not safe to say now that a decision has been reached—two or three times in the past year it was surmised that an agreement was concluded, the announcement of which was almost instantly followed by a disclaimer—the conditions surrounding the present action of the Gas and Electric Lighting Committee of the City Council go to show that the end is at last and that the contract is signed and sealed. Under the scheme evolved the Company agrees for the next five years to supply gas at the net rate of $1 per 1,000 cubic feet, and at the end of the five years the rate, for a further period of five years, is to be 95 cents per 1,000. The Company may also charge a meter rent of 25 cents per month where the index shows that the quantity of gas sold in that month did not exceed 200 cubic feet. The charge that may be made for making a service connection is reduced to $2.50—hitherto the minimum charge for this class of work was $4. It is also to be the rule that the Company may exact a penalty of 15 per cent. where the consumer is delinquent in the settlement of his account. This is something of an improvement over the proposition to compel the Company to dispose of its product at 75 cents, and while it also looks to be a fair compromise, it is not anything more than fair. During the year that will end on December 31st the Company likely will have sent out 125 millions cubic feet, and this of itself is sufficient to show that 20 candle gas in Toledo is no astounding bonanza on the basis of a dollar rate; in fact, Mr. Faben and his associates will have all they can reasonably attend to in reaping a profit out of their sales to pay interest on $100,000 bonds and to return a fair dividend on $720,000 of capital stock—although we all know that the wide-awake Faben is well up to his business in every particular.

During the time of this discussion by the authorities over the Toledo

rate, the loudest of the "issue raisers" were particularly uproarious concerning their admiration of the 80 cent, gross, gas rate prevailing in Cleveland, but in the fiercest of their mouthings they never so far forgot themselves as to emit a note of comparison; for instance, they did not declare that the sendout per annum in Cleveland was over 600 millions cubic feet against the 120 millions sent out by the Toledo Company, that the candle power in Cleveland was 10 per cent. lower than that of Toledo, and that the Cleveland center as a locality for distributing gas was far more favorable than the Toledo one. Nor was it to be supposed they would do else than sneer at the presentation of such and other co ordinate facts—for it may be taken for granted that the Com pany did not neglect to set forth these things in their proper light. The proprietors of the Company are to be congratulated on the coolness displayed by them in this long-drawn out contest, and not a little of the credit therefor is to be put directly to the account of Mr. Faben, who is a past master in the art of doing things smoothly. Possibly, if tactics of a somewhat similar nature had been adopted in the earlier stages of the conflict at Cleveland, even the redoubtable General Meyer and his ardent supporter, Mayor Rose, would not have so completely succeeded in throttling the gas proprietors of that city.

MAKING THE MOST OF THE SITUATION.—Corporations, of course, are very like in nature to those who control them, and as humanity fur nishes the power that actuates them, it is not surprising that corporate acts frequently resemble the doings of the ordinary merchant; and the ordinary merchant is always going to have the best of it, as far as he may. Our friends, the electricians, are beyond a doubt human, even though they are the dispensers of a something most subtle, most elusive, or what not, for when it comes to charging for the electric currents used in lighting, they make the most of their opportunities. This is unquestionably the era of high and magnificently equipped office buildings, and some architects, in their desire to be "thorougly up to date," have counselled the owners of the buildings under their constructive charge to place entire dependence on electric wiring for the lighting of the structures, to the entire exclusion of gas piping, and this even in instances where no provision has been or is to be made for the maintenance in the building of an isolated electric lighting plant. In several instances the owners of such buildings, notably in Boston and Chicago, have experienced the human impulses of the electric lighting suppliers, who, having furnished, under contract to last for a year, currents to lamps at so much per lamp per hour, at the expiration of the contract have demanded a round increase in the rate for a renewal. Of course, the owner has opportunity for relief by the placing of an isolated system, but he could have had that in the first instance through having the structure piped for gas; further, in the latter instance the "relief" would have amounted to virtual insurance from any ill effect of the hu man impulses that will creep out in the commercial life of corporations, be the latter electrical or otherwise.

THE PROCEEDINGS AT ELMIRA, N. Y.—Judge Rumsey Miller, the Surrogate of Steuben county, N. Y., is at present engaged in the taking of testimony on a petition to dissolve the Elmira (N.Y.) Gas and Illuminating Company. Judging from the array of legal talent marshalled in the case, it is evident that the Company must have some assets that are worth while disputing for, an assumption that is warranted by a conning of the names of some of the legal celebrities retained in one way or another by the parties to the proceedings. Indeed, it may be taken for granted that lawyers of the caliber of Townsend, Short & Davies, and Joseph Larocque, of this city, A. C. Eustace, of Elmira, R. E. Drake, of Syracuse, and others of equal standing, are not engaged in the game of stalking a horse that has not a sound leg under him. We suppose in due time the real meaning of the proceedings will be apparent to th se on the outside; meanwhile it is odd to hear of steps being taken to dissolve a corporation that is admittedly carrying on a profitable trade.

DEATH OF MR. CHARLES PLACE.—We regret to report the death of Mr. Charles Place, at his home in this city, on the morning of Wednesday, November 8th. The funeral services were held the evening of November 10th. Mr. Place was formerly prominent in the management of the Mutual Gas Light Company, of this city, and President and Treasurer of the Consumers Gas Company, of Jersey City, which is operated under lease by the United Gas Improvement Company. In due time we will give to our readers some history of his life.

IT is understood that the Commissioners appointed under the Lyford act to appraise the plants of the Bay State Gas Company, of Boston, Mass., have reported the same at $2,500,000.

[OFFICIAL REPORT—REVISED BY THE SECRETARY—CONTINUED FROM PAGE 657.]

TWENTY-FIRST ANNUAL MEETING OF THE AMERICAN GAS LIGHT ASSOCIATION.

HELD AT CHICAGO, ILLS., OCT. 18, 19 AND 20, 1893.

FIRST DAY—AFTERNOON SESSION.

The President—The next paper we shall have the pleasure of listening to will be that upon

GAS ENGINES IN THE UNITED STATES,

by Mr. F. H. Shelton, of Philadelphia.

Mr. Shelton—Before reading the paper I will say a word of encouragement to the audience—that I do not intend to read the entire paper. Two thirds of the paper is simply an appendix,[1] and the reading will be omitted. I simply call your attention to the first part.

Regarding the subject of this paper, I have two convictions, viz.:

1st. That gas engines do not occupy the position that they intrinsically should as gas consuming appliances; and,

2d. That this Association should have some sort of convenient memoranda of the engines that have appeared upon the market, which memoranda decidedly has not heretofore existed.

Hence, what I am endeavoring to do in the paper herewith offered you is,

1st. To show some figures that will make us realize what a small relative field gas engines occupy, hoping that my comments and your discussion will induce some correction of whatever faults now exist; and,

2d. To give a brief description and illustration of every make of gas engine that has commercially appeared in the United States market.

Let me first make my path somewhat clearer by stating these further points. I am not going into the history of gas engines in general. I refer those who care to coach up on such to the scant literature existing upon the subject. In the United States I find almost nothing. There seems to have been no original thought on gas engines evolved on this side of the water. There are no American books or treatises; the only "native" articles in the gas journals worth noting are graduating theses, by Albert Spies (AMERICAN GAS LIGHT JOURNAL, Aug. 2d, Aug. 16th and Sept. 2d, 1885), and by E. Kidwell and E. R. Keller, giving a detail of Otto tests (AMERICAN GAS LIGHT JOURNAL, for February 17th, 1890.) The balance of our gas journal gas engine literature is made up of scattered copied foreign articles, and thinly disguised makers' advertisements.

An illustrated historical "report," even by the "Franklin Institute," of Philadelphia, an American institution to the core, is upon a foreign make.

At present there is a series of articles upon "Modern Gas and Oil Engines," by Albert Spies, running in *Cassier's Magazine* (Potter Building, N. Y., March to October, 1893, inclusive, 8 numbers at 25 cents each), but it is practically but a running description of miscellaneous typical domestic and foreign makes. No system of classification is followed; nor is any complete enumeration of either foreign or domestic forms professed or given. Even the gas man has written upon the matter perhaps more meagerly than upon any other subject. The New England and Ohio Associations have never had a gas engine paper. The Western has had but one, by Mr. E. H. Jenkins, in 1891, which was more especially a comparison of gas with steam for one particular application. In short, the only paper on the general subject that I can find in all our Associations is one by Mr. Geo. G. Ramsdell, 13 years ago, before this Association. If you wish to read up on gas engines you will find, as far as I know, nothing of American origin beyond the above, and a few Franklin Institute articles, published in its *Journal*. Practically you will have to turn to the English works. The best are: "The Theory of the Gas Engine" and "The Gas Engine, Its History and Practical Working," by Dugald Clerk; "Gas Engines," by Wm. McGregor," 1885; and "Gas and Petroleum Engines," by Wm. Robinson, 1890. Also "King's Treatise on Coal Gas." The first four can be had of the D. Van Nostrand Company, 23 Murray street, N. Y., price 50c., $2, $3 and $5.50, respectively.

I am not going into the theory of the gas engine nor its proper design. On this standpoint those interested will find in the above books that theory also is expounded to one's heart's content. I am not discussing *Canadian* engines. I have no knowledge of what has or has not been done, or of what forms have appeared "across the line." I am not discussing essentially oil or petroleum engines, such as the Brayton or Priestman, which, though blending imperceptibly into gas engines, are yet of no special commercial interest to sellers of gas.

1. This appendix will be printed in the JOURNAL, after the regular official report of the proceedings has been published.—EDS.

I am not claiming particular wisdom upon the subject of gas engines. I have only a general interest and knowledge concerning them.

If the makers of gas engines, who *are* best informed upon the subject, will not join our Associations, nor give us knowledge or papers upon their wares, we must get such ourselves as best we can (and they cannot then well object if such be incorrect). I am only offering you some gathered information and opinions, regretting for this reason, at least, that not being in the gas engine business proper, I cannot cover the subject as well as it might be covered.

I am not, nor is the company with which I am connected, in any way, directly or indirectly, commercially interested in the manufacture of or in promoting any make of gas engine whatever.

Hence whatever I may say—however correct or incorrect such may be as to fact or conclusion—it is at least done in sincerity and without an axe to grind. Further, as this is purely a personal paper, not part of it must be construed as the United Gas Improvement Company's views, or as that Company's liking or disliking, indorsement or non indorsement of any particular make of engine. In view of the delicate ground that one treads in commenting upon or in even describing various makes of any machine, I must insist upon the above point. With an apology for this long preliminary, which has yet seemed to be best, let me get down to my direct subject.

To verify my ideas as to how little gas engines are used relatively, I sent out a number of circulars asking specific replies to 26 categorical questions relating to the matter. These we sent to typical men in the business; men who are managers of medium-size works and upwards in all parts of the country; men who as a whole know what they are talking about and represent that hard working and progressive force in the business. A very gratifying number of replies were received. It has been impossible to acknowledge the receipt of each one of these, and I wish to herewith express my hearty appreciation of and thanks for the same. I think I am right in taking the figures and ideas so gathered, as a fair basis for conclusion.

In about 60 cities ranging from 8,000 to 555,000 and aggregating a total of 4,061,000 population, I find in use only 540 engines, or but 1 *to every* 7,500 *people*. The percentage of output used by these gas engines is so small that only 20 of those answering figured it out, or even estimated it. "Too small to calculate," "$\frac{1}{10}$," or "$\frac{1}{8}$," or "$\frac{1}{2}$ of 1 per cent.," were common replies. Most gave figures that ranged between 1 and 3 per cent., but five were over 3, and the solitary high one was 16 per cent. The average was but 3 per cent.

In view of the fact, however, that more than half of those answering felt that the percentage was inappreciable, or too small to calculate, I personally think that *the real average amount of output due to gas engines is but* 1 *to* 1½ *per cent.* And I also think that the 60 cities in question are fairly representative of the matter throughout the country.

There is no doubt whatever but that the actual amount of gas used by gas engines is a very, very small proportion of our output. The "progressive modern gas man," as he so likes to be styled, pursues burners, governors, stoves and other details relentlessly; he works up an output for purposes of heating and cooking of 10, 20 and even 50 per cent. of his business, and yet is content to have gas engines—mechanically efficient gas consuming appliances that as a whole are thoroughly tried, economical and satisfactory—responsible for but a paltry faction of his output. That a better showing can be made is shown by the results obtained in individual places; but as a whole the facts are as I have stated. Now, should this be? Is not something wrong somewhere? Is it going to continue so indefinitely with this unsatisfactory showing?

The trouble may be in four different directions:

1st. In the gas engine, as a machine.

2d. In the gas engine not being good compared with other motors?

3d. In the makers?

4th. In the gas man?

1*st. Do gas engines as machines do their work, and are they all right in themselves?* I think the general opinion is that they are, and that whatever fault exists is not in them. The great majority of replies on that point, indicated that no excessive time nor attention is requisite on the part of the user, nor other than the ordinary care and attention required than is given to any motor or other machine. Only 5 per cent. thought to the contrary. The repairs were almost unanimously considered as "reasonable," "moderate," and "low"—there being but three dissenters. It was practically agreed further that if engines have any kind of decent attendance, they rarely call for any special time, attention or expense on the part of the gas company after the first starting of them, and understanding of their working on the part of the user, and in answer to the general direct question, "Do they, as a rule, give satisfaction to the users?" 96 per cent. unqualifiedly answered "Yes;" some adding "every time," "decidedly," "first class," and like emphasis. The chief dissenter from this general verdict is a man who prides himself on operating also "the finest electric station west of the Mississippi." I think that we can feel, with a fair make of engine and decent attendance, gas engines will do the work and give satisfaction in 95 cases out of 100, and that whatever fault exists it does not lie in the engine as a machine.

2d. Are other motors superior?

Water Motors.—I do not think we need consider these as practical competitors that amount to much. 1st. They are made only in relatively small sizes. 2d. In many towns they are useless, owing to lack of water pressure. 3d. The growth of the meter system acts against them. 4th. Small powers where gas might feel their competition, will in the judgment of the writer, be largely covered by small electric motors. (Note that I say small powers; I will explain this below). While water motors are good and cheap in many cases, comparing favorably with other powers in cost both of installing and of operation ($50 to $100 per horse power), yet, for reasons unnecessary to enlarge upon here, their use is, as a matter of fact, limited, and to my mind they are not any great factor in checking the growth of gas engines. From the replies received on this point, I think this opinion generally held.

Steam Power.—In factories with a large power, where its surplus is sublet from a countershaft, with no new engine of any sort needed, I find rentals varying from $40 to $100, and a very general rate to be $75 per year per horse power. The average price of gas, at 40 points for gas engine purposes, was $1.65 per 1,000. Running 300 days at 10 hours, and 20 to 25 feet per hour per horse power, would make a gas horse power cost $100 to $125 per year. This is more than the cost of this form of steam power, but as a gas engine in all likelihood would not need to to give full power all the time, and hence would save gas in proportion, and as gas will in all likelihood be sold—as in many places it is now—for gas engine purposes, at considerably less than $1.65, I think we can assume that these costs per horse power are not far from the same. But as the steam user in this case needs to invest in no plant, steam will have the preference. The real comparison should be made with a new plant, where either a small steam or a small gas motive power outfit must be put in complete. The first question of course is cost, and here, unfortunately, we are weak. A steam engine and boiler both can, in the majority of cases, be put in for the cost of the gas engine. And yet, despite that, I do not fear the steam competition. The desirability of no fire nor ashes, no boiler, no danger, no delay in getting up steam pressure, no running water needed, no engineer's license, less space required, no change of insurance, of cleanliness and other advantages, is so great that unless a gas engine costs more than a steam plant a proper showing will usually secure its installing. The cost of operation of the two varies so greatly, in view of various prices for gas, efficiency of engine used, work done, cost of boiler, coal, etc., that I cannot attempt to go into figures, wherein one could cipher a week. I can only say that the majority of small steam plants work extravagantly and require paid attendance. Moreover, the majority of small powers work intermittently. In most cases, with a low gas rate, gas motors needing no engineer will be found to be as cheap to operate as steam, and often very much cheaper. It is a question of local conditions, unquestionably. If a man is about to install a small power plant, with steam vs. gas in mind, I think that with the rates for gas that at this date most companies should be willing to make, together with the decided advantage of the gas engine, that as a rule we need not fear but that we can get the business. Of course, where a steam plant must go in, in any event, for heating, say, it is different; but as a whole, and in ordinary cases, I do not think that steam competition is the trouble with the gas engine business.

Electric Motors.—Here we do have the great competitor of the gas engine. So much so is it that I think we may say in general that it is not water nor steam power that we need fear, but our common friend and enemy, electricity.

The electric motor has as many advantages as the gas engine; the present cost of installing is less, and the elastic rates for operation have tended to enlarge their use. Their advocates claim as follows: They are compact, can be put often where a gas engine cannot, and can be connected or shifted easier; they require even less attention than a gas engine, need no water, require no effort to start, give no odor, take up less room, are cleaner, sound better than the exhaust of a gas engine, are "handier," and are "up to date," "modern," "electric," and all that. Now this is, in the main, unquestionably a strong array of good points. Supplemented by the push of the competition from a score of makers, aided by questionably paying rates from the local electric company, they have undoubtedly done a large and growing business, and checked the use of gas engines. As a rule they give satisfaction. Now, I grant all this; but to get right down to the bottom of the matter, the real

reason for their growth, to my mind, is not that (excepting in the smaller sizes) they are superior to gas motors, but because of two points—"push" and lower selling prices. It does seem to me that both these points can be met by the gas people if they want to meet them, and, understanding the real facts better, will shake off the lethargy and passive acquiescence to a claimed superiority of the electric motor, that to me it seems has largely dominated the past.

In the first place, gas engines, as motors for general small power purposes, are as good and have fully as many advantages as electric motors, if we except some few special applications and very small sizes, such as are used in offices, etc. I mean comparing sizable power motors of 3 to 5 H.P. and upwards. Gas engines are compact; they can be installed almost and practically anywhere; they require no boiler, no coal, no ashes, no running water supply, no constant engineer or attendant; if of proper design and arrangement, they are as clean and odorless and as quiet as an electric motor. Starting need not be, and is rarely, a trouble in small sizes; in larger ones "self starters" will cure that point. In short, there is no reasonable doubt, as shown by the almost universal verdict in the answers received, as already stated, but that gas engines as a whole give entire satisfaction. As far as arguments, talk, or facts go, there is no reason, from this standpoint at least, why we should let electric motors take the business. In some minor points electric motors are slightly better; but on the other hand gas engines have positive advantages over the motors. For instance, despite claims to the contrary, the liability of interruption of power current is distinctly greater than of the gas supply, and always will be, from the very nature of the high tension operation of an electric station and its exposed wires, compared with a gas system. I need not enlarge on this. The effort to keep in gas meters to insure an electric service is well known to us.

Again, there is a source of danger existing around an electric motor, through currents, wires and defective or abraded insulation, that does not accompany a gas engine. It may be contended that gas is an explosive engine. True, but as a matter of fact I cannot learn of a solitary accident from such cause, in the use of gas engines, that would off set the injury or deaths to the many who have touched, inadvertently, live motor wires. Gas engines are not decorated with signs reading "Danger," "Hands Off." I do not think that we can excuse lethargy on the ground that motors are generally or essentially better than gas engines. Come right down to facts, and each one is first-class; each has some slight advantages. For small motors, fans, office uses and handy purposes I think the electric motor the better; for 3 to 5-H.P. and upwards my choice would be for the gas motors; the surety of service, reliability, low cost of repairs, and still more, the low cost of operation, being prominent reasons therefor. At present the motor leads, I think; not from superior merit, but from a wide advertising, from cut rates, from its novelty, from being "electric." How of the future?

To my mind it rests on our adequately covering the two points that have given electric motors their present position, viz., push and selling prices.

Push.—This rests with each individual gas man. I firmly believe that whether 1 to 5 per cent. or 15 to 20 per cent. (according to the town) of one's output may be used for gas engines, depends on how the business is locally handled. I refer further to this in part 4th.

Cost.—Here is the knotty problem. Electric motors are relatively cheaper to make; they have practically but one rotary movement. A gas engine has that and a reciprocating and crank action, several minor ones and twice as much weight of metal. Hence it is not unnatural that their price should average much more than that of electric motors. How are we to meet this? First, by a considerably lower price for gas engines than has prevailed heretofore. This, I think, will come, and I take it up in the next heading. Second, by showing that, excepting with cut and hence unstable rates, the actual cost of operation is not cheaper with electric motors, as is claimed, than with gas engines. For instance, I am advised that the prevailing schedule rate for contract intermittent electric powers in the New York, Boston and New England territory is $120 to $60 per year per horse power, for from 1 to 10 horse power and upwards. A gas engine, consuming at the rate of 20 to 25 feet per hour, on $1.65 gas (an average), running *full time*, 300 hours yearly, would only equal $100 to $125. It will readily be seen that with similar intermittent work the gas consumption, and hence cost of operation, would fall quite in the range of the electric costs; and that with gas at $1 it would undoubtedly average cheaper; moreover, using gas as only measured costs only for the power used. The majority of electric motors are not on meter system, but on contract rates, whether power is used or not. There is no chance of the customer saving. Of course, the meter system may grow, but what is its essence? It is the getting on a paying basis, the measuring and selling by measure, and the usual result is an increase of cost to electric users, in such a change. Of course, the great trouble that no theory or schedule meets, is that of cut rates. If money is to be lost, however, it is better to let the other fellow lose it. Special rates for day service, "to utilize one's plant in the daytime," are often quoted. They can as consistently and as desirably or as undesirably be made by gas companies for engines and day power purposes. It is a matter of judgment.

As a rule, I believe that if an electric company is charging paying rates, a gas engine can be operated for less money, power for power, be the more reliable and cost less for repairs. Many answers received support this belief, and the tendency, also, towards the raising of electric rates from old contract figures is dwelt upon and is pertinent to the question of which will be the cheaper power.

Getting the business will not be done by sitting still. Work only will do it. Both systems are here to stay, and to my mind those who put out the most energy will get the best of the returns.

The tendency of gas is towards fuel and mechanical purposes. I think that special rates for such, to each special business, can be made to advantage to an extent greater than in the past. With gas at $1 to $1.25, good engines, at a lower price than heretofore, and the gas man as everlastingly sticking to it as the electric people, I distinctly and firmly believe that gas engines can be made to get their half of the business.

3d. Is the trouble with the makers?

I am only stating facts in saying that the great majority of gas managers, including some of the most conservative and thoughtful men in the business, feel that the fault does lie in what is thought to be an illiberal policy of the leading gas engine people. (Whether the skirts of the gas men themselves are clear, I will take up later.) It is felt that gas engine prices are enormous. To the general question as to why more engines are not in use, "high first cost," was the reply in 50 per cent. of the answers; and to a more specific question as to cost, 94 per cent. replied that the excessive cost was largely and often the only reason preventing much greater use. There is almost universal accord of belief on this point.

Of course there are two sides to every question. The engine makers point out that horse power for horse power, you cannot expect to buy a gas motor as cheaply as a steam engine; for instance, for the reason that, from the nature of the working fluid and that practically gas engines are but single acting, it takes a larger cylinder and heavier engine to attain a given power. For instance, a 25 horse power steam engine will weigh perhaps 3,500 to 4,000 lbs.; a 25 horse power gas engine will weigh nearer 6,000, or ½ more. In smaller sizes the difference is even greater. Hence, if the cost per pound for making the engines is the same, we may naturally expect to have to pay the makers ⅓ to ½ more per horse power if we choose to use a gas motor. But they go further and say that superior work is required in the gas engine to that requisite in the steam engine. They point out that the moving parts are required to be gas tight under 200 lbs. pressure or more; that they are subjected sometimes to heat and destroying action that the steam engine is not; that the explosive nature of the impulse is harder than the more gradual impulse of steam; that with the high temperature there is a difficulty of lubrication, requiring special appliances, and that a nicety of adjustment and precision of action are requisite, that in brief demands a better quality of work than is put in a steam engine. The makers state that the proper erection and testing of each engine costs as much as the "tool work" alone, for instance. This is all of interest; it is no doubt to a certain degree correct; but personally I do not think it is an adequate explanation. No one questions the workmanship or the operation of, for instance, the Otto engine. It is a beautifully built, smooth running piece of machinery. But so are the better class steam engines. One can get good, bad and indifferent in either gas or steam, but comparing the better ones, I do not believe better work is or should be needed on gas engines than should be put in steam engines. If I am wrong, and better work is needed, then I say it is high time the design were changed to a cheaper form of construction that will effect the same work. That this is the tendency is shown by the Otto people in discarding the slide valve (expensive to make and so delicate in adjustment that a duplicate is part of the outfit of each engine) for the simpler, cheaper, poppet valves. In some other engines it is aimed to make one combined valve do all the work, thus simplifying and reducing the cost. Of course, here frequently efficiency is sometimes lost. New charges get diluted with air or the burnt products of combustion. The very highest economy undoubtedly calls for the nicest design. But my point is, that as a rule complexity of detail and design, involving high cost, is a great fault in many gas engines. Run through the more prominent ones, later in this paper, and note the gear tacked on to the cylinders. I do think that

designs can be simplified. For instance, why in the Otto is it necessary to interpose four cog gears to drive a simple side valve shaft from the main shaft?

Let us see what relative costs really are. I take an Otto as a typical high class standard gas engine. Freely admitting its excellence of make up and its degree of standardness, so to speak, may console slightly the makers for the unfavorable conclusion I draw. A 5 horse power sells in the neighborhood of $450. A 5 horse power steam engine can be bought, of excellent make, for $150. A 25-horse power Otto costs perhaps $1,250. A ditto steam engine $400 to $500. Leaving out extras that apply more or less to both, it is evident that the gas engine costs at least 2 to 2½ or three times the cost of the steam engine, often more than sufficient to cover the boiler too, etc. Granting the claims that the cost per horse power may be ⅓ or ½ more, owing to size of engine, and that a somewhat better grade of work may perhaps be needed, I submit that such do not yet account for the great disparity indicated above.

It is natural to get all that one can for one's wares. I do not blame the makers for that; but as long as such disparities exist the makers cannot lay the blame solely on the gas men for the small use of gas engines, nor wonder at the current belief of an undue margin of profit.

The gas men do not gainsay a reasonable profit, but the general feeling is that the matter will have to be adjusted somehow so as to enable the sale of gas engines at ¼, ⅓ or ½ less than at present, or to more nearly compare with the cost of a steam plant, if a more extended use is looked for.

There are now a great many other engines on the market and springing up. Few have yet attained prominence. Some strike for the same prices as of old, but others are selling for less and I believe their influence will be felt. I have no preferences or prejudices among gas engine makers. For the sake of the gas sellers and the gas men at large, I hope that through the agency of these new engines prices will be very much reduced—believing that all interests will ultimately be the gainers. The gas men can encourage this by looking up advertising and assisting those engines that do sell at lower figures, provided of course that there still be reasonable good work and design given.

In the matter of time payments versus spot cash, repairs, promptness of shipment, the carrying of local stocks and kindred points often complained of, many think the makers could profit by a comparison with the methods and results shown by those handling electric motors.

In design also there is room for improvement. Sometimes the noise of exhaust is obnoxious. In such cases it can be cured by interposing sufficient exhaust pot, or a pit, with muffling grills. But these are "extra" to the cost. With a design discharging at atmospheric pressure, like the Atkinson, the trouble is removed. Again, the question of starting is yet a nuisance, in large sizes. To use a small motor solely to start a larger one is surely a primeval arrangement. "Self starters" are growing into use. They ought to be reliable, safe, and part of the design of all but the smallest sizes to insure easy starting and forever do away with this complaint. Will anyone say, moreover, that the gas engine will always be single-acting? The Griffin now is double acting, and in certain ways is a step in advance. Does it not seem that the next great advance in gas engines that will bring them much more on a parity with steam, as to weight, size, and regularity of action, will be the attaining double action, as the rule instead of the exception, by overcoming the difficulties so far existing?

The gas engine practice on this side has been that of "copy." The Otto cycle and old lines have been adopted, hashed and rehashed into a score of forms, but excepting in mechanical details and arrangement there has been scarcely any invention that can be pointed to worthy to be styled an American real development of the gas engine. Among gas men there is little real knowledge of the subject. Among the makers there is but little real technical engineering development. This is, of course, more a passive than an active fault. There is room for such invention and progress, however; it is within the maker's province, and with the increased number of them I am in strong hopes of seeing it attained.

4th. Is the trouble with the gas men?

To be honest, I think that while it has largely been with the makers, yet a good round portion of it can be put upon the gas men. Prices have been high; it has been hard to push engines; there have been many difficulties to contend with; but as a whole I think the average gas man has said to himself, "Oh, well, I can't do anything with them," and lazily has laid them unduly aside from his thoughts. Suppose prices are high of the best make. There are 20 other forms to-day on the market; but the average gas man can scarcely mention five, even, by name; much less knows he that some are much cheaper than others or than before. In other words, he is not really posted.

I think, too, that we have somewhat lazily said, "Oh, well, the electric motor will get that," and have given up the fight prematurely. Some again say, "We have no factories, our town is residential." Have such towns no elevators, no printers, confectioners, or ice-cream freezers, no laundries or a score of other semi-domestic power purposes existing in every town that can be developed by the seeking?

Natural gas, specific cheaper cost of electric motor, perhaps, and other reasons are unquestionable real reasons in many cases for the non-use of illuminating gas for power, or of gas engines, but to me, many general reasons given of "not popular," "no field," "ignorance of merits," etc., were hardly sufficient. Some, more frank, admitted "want of push."

One man—honest beyond his compeers—answered, "No, I am ashamed to say we do not push them beyond a general recommendation, and can give no good reason why we do not." A "general recommendation" will not suffice. We must especially post ourselves and push them, but with such effort we can create a field, can dispel ignorance, can make them popular by persistence, precisely as a gas stove business is built up. At the beginning it may be necessary to put in much hard work, to give free piping, forego commissions, etc., but every engine located means a substantial use of gas per year. Every 4-horse power engine running regularly means one-third of a million feet per annum. Is such not worth striving for? Not only to get one engine in, but a really good number in use? I do not mean to be unduly or improperly severe in my remarks as above. It may be that our energies as gas men, that are pretty apt to be fully spent in some way, have yielded better return in other directions. But I cannot get away from the essential text of this paper, viz.: that only 1 or 2 per cent. of our outputs goes to gas engines. Does that seem right, and cannot it be bettered?

Let us consider the sake of example—of our own use of gas engines. As scarcely one works in fifty uses them, I asked the question, "Why do you not use gas engines at your works for driving exhauster or other work?" Of some fifty replies, two-thirds argued, "Steam plant is already in; we have to have steam anyway; we use breeze for fuel that is otherwise valueless, hence steam power is cheaper." About one-quarter gave the variation in speed of exhauster, and difficulty of regulation, as an objection, and perhaps one-third said that even if this were satisfactorily provided for, they probably would yet not use gas in any event. A few thought that gas power was more liable to derangement under a stoker's oversight; that steam was more reliable. One that the steam engine plant was cheaper.

Now, I am perfectly willing to admit the force of the above arguments, as reasons of due and considerable weight; but to my mind they are neither unanswerable nor sufficient. The gas man as a talker of the abstract beauties of gas engines is letter-perfect; for sheer consistency sake, for policy, for the sake of example, and often for absolute economy, I hold that he ought to have a motor running at his own works, as a sample. I will even go further, and say that even if it involves a small loss in operating expense I still think the company would gain in the end. Many gas superintendents are frank in this matter—conscience is at work! Several wrote that their non-use was pure conservatism. While one said, "Life is too short," and another, "I give it up;" yet many said, "If regulation were perfected they would probably use gas;" and still others said, "Regulation has no terrors for us."

Thirteen years ago the matter of regulation was suggested in our meetings, and to day we are no further advanced. On this point we certainly are lacking. Water wheels, engines, motors, mechanisms of hundreds of forms, have governors all sufficient. Must we confess that we cannot design a governor to handle merely a varying speed of the load to a driving power constant or adjustable as we please? It seems to me that this bugaboo we should not be proud of. Why it should be essentially more difficult than with regulating steam power I fail to see. In some few isolated instances (Am. Gas Light Journal, 10-12-'84) exhausters are driven by gas, but it is distinctly exceptional.

Aside from exhausters in the larger works, there is certainly room for the use of a gas motor even if it be granted that "steam is needed anyway." Here are some of the other power uses around a gas works:

Operating a coal conveyer; operating a coke conveyer; operating an oxide conveyer; driving rotary scrubbers; drive fans or blowers; power pumps for water, oil, tar or ammonia; operating elevators; operating coke crushers; operating shop machinery, pipe threaders, drills, etc.

Is it not worth while to install a gas motor for at least one of these purposes, for example's sake?

Another direction wherein I think the gas man at fault, is in not be-

ing posted as to the various makes and prices of engines, so as to be able to talk intelligently, and right to the point, with an inquiring customer. How is it now? A man inquires; the gas company estimates, fiddles over what form of engine is best, finally concludes to recommend a prominent one, and offers to write and get prices, etc. The intention is good, but method weak. Meantime, the customer is buttonholed by an electric hustler with figures at his fingers' tips, and when the gas man seeks Jones, after a week or two of time lost in correspondence and keeping it on his desk, the trade is lost.

There are now at least 20 active makers of engines on the market, most of them good. Why should we not keep a file of up-to date cuts, circulars and rock-bottom prices, to talk business from? If an expensive make is too high priced, often a cheaper form will yet fill the bill. It is to aid in correcting this point that I have compiled the list of engines and addresses attached.

Another point: Promptness of shipment and repairs. One man said: "If a customer wants electric motors there are two or three local concerns probably able to supply him, and at once. They are carried lo cally in stock. If he orders a gas engine he is lucky to get it in six weeks." This is putting it somewhat strongly perhaps, but the underlying part, truth at least, will be recognized by most of us. I cannot suggest the exact remedy. It must be by better co-operation between the local gas companies and the engine makers, and it partially rests on the gas men to insist upon and to bring this about.

Again: *Repairs.*—In any sizable place it would well repay a gas company to educate their outside man into understanding and looking after gas engines, as much as stoves or patent burners. It is done for these latter, why not for gas engines? Then if anything gets out of gear, with his intelligent direction, in nine times out of ten it could be at once fixed on the spot or repaired by a local machinist, at moderate cost, without involving sending to the maker and consequent irritating delay and loss of time to the engine owner.

The engine makers claim that the non-use of gas engines is largely due to the gas men keeping the price of gas up, so that it costs too much to operate them on any but intermittently working powers. That is, they argue for a special day or power rate. Letters and editorials on this may be found in Progressive Age, Nov. 15, 1890, pages 511 to 547. I am not going to argue the old question of rates here, but will simply say that while I do not see wherein the gas men could cut to the extent asked, yet I do think that more could be done in this direction than has been done and to the gas companies' advantage. Certain it is that gas engines are day consumers, are constant consumers, and are good sized consumers, and to me it would seem worth while to allow a special rate provided its reason and method may properly and consistently be made to appear to the general public. Of course therein lies the danger.

The question may be asked, of what use to the gas men are gas en engines used with gasoline? I say as educators. Every such motor installed shows somebody what can be done, and some of those who see it will sometime be on the market for power and a possible customer of the gas engines.

I believe that gas men ought to encourage portable gasoline motors, gasoline launches, pumping engines in country houses, etc., etc. Mains do not reach such cases. We could not get the business now anyway, but commercial compressed "gas in packages" may some time come, and meantime all these small motors, practically gas motors working on gasoline, educate the public and make it easier for the gas company to install gas engines when there comes a chance along their mains.

So it is for gas engines for electric work driven not by illuminating gas but by producer gas. On the general question of gas engines for electric plants I can barely touch. Opinions vary widely, although thousands of horse powers are so used Some answer "Yes," some "No," most that they would not say off-hand. It is a question of condition undoubtedly. Personally I incline towards them; certainly for the smaller plants. I believe that the service can be made all right by proper design of plant; that the gas power at least, when combined with our gas plants, is in many cases the very best possible. And with producer gas, every one of us ought to know and to advertise the fact that through the gas engine the highest absolute efficiency of any form of artificial power, so to speak, has been attained. That is, the best compound condensing steam engines consume 1½ lbs. of coal per horse power per hour. This is "gilt edge" work. Those who work with between 2 and 3 pounds are generally amply satisfied. This is on big plants. Many run at 6 and 7 lbs., but most small plants of 20-horse power and under average in ordinary working conditions (not tests) 11 lbs. (Robinson.) But gas engines with producer gas, even of moderate size (and having to use it in the ratio of 4 to 1 as to quantity, compared with illuminating gas), without great effort will run from 1 to 1½ lbs. only, averaging twice the efficiency of the best steam plants. The Otto people stand ready to guarantee 1¼ lbs. Bear in mind that this is on producer gas; "the high (relative) price of ordinary illuminating gas makes *the unit of heat* from gas more expensive than that from coal; hence for large powers the gas engine using ordinary illuminating gas cannot compete with the large steam engine using coal." In small engines we now have relative economy from a summary of all factors using illuminating gas, but for the larger plants, producer gas must be used to secure it, which lessens our direct interest as gas sellers. With a cheap producer fuel, however, and coupled engines of 100 horse power in series, or the larger sizes as made abroad, I do not see why in a great many cases the most perfect power for dynamos is not so to be attained. I should certainly consider the matter at great length before deciding against such were I installing a plant. My argument here is that producer-gas driven engines educate, too, and hence are worthy the gas man's influence.

The small manufacturer to whom we point them out is the more ready to install a small engine to use our gas when he comes in the market and is on our mains.

A direction wherein I think there is a large field yet to come for selling gas through gas motors is that of street car propulsion. The advantages of the gas engine for such purpose I touch upon under the Connelly heading following. The Messrs. Connelly tell me that the motor is now in about the shape they want it and that they expect it shortly to become more generally known; and, further, the important point, that while they have heretofore been working with gasoline and on Pintsch gas, the later tendency has been towards the use of city gas, using merely a compressor at the car station. Here is where the gas and the car people can unite to mutual gain. The car people do not want to manufacture gas or run a gas works. The gas people do want to sell their product. They want just such customers and just such advertisers of gas power as numerous cars running most of the hours of the 24 would become. Hence there ought not to be great difficulty in coming together on a mutual commercial basis. Electric lighting and electric car lines lie naturally together, and are often operated by the same concern or interests. Are they any more naturally allied than such a gas union would be indicated above?

The gas hammer is first cousin to a gas engine; the motive action is essentially similar. In England I believe they are somewhat used. In this county I know of none as yet. May we not look to it also, before long as another gas consuming piston device, that will add to the sales in the larger cities where iron working shops exist? I illustrate the gas hammer as it is intrinsically ingenious, and so closely allied to gas engines.

To sum up, as far back as 1878, Mr. Chas. H. Nettleton, in a paper[1] before this Association, pointed out (and was, I believe, the first to so point out to this Association) the possibilities of the gas engine. Within a year or so after the practical introduction of it into the United States, he had two or three installed in his town. It is unnecessary to here repeat arguments and facts that we know full well and that are now almost platitudes; suffice to say that the doctrine that he then enunciated is as true to-day as then. It is true that owing chiefly to electric motors it is now harder to install gas engines than formerly. But is it more so than in other points involving work in the gas business? Are not conditions throughout more difficult to meet than those of a dozen or fifteen years ago? Competition is keener, but we are still "keeping right along," and with gas engines I believe that we can "keep right along," and in regard to the four points I have discussed—I believe

1st—That as engines they are all right.

2d—That as compared with other motors they are equally good and that they can hold their own, if properly pushed and sold.

3d—That while in the past the fault has largely been due to the prices of engines; that this will be bettered in the near future through the newer makes appearing, and

4th—That the gas man, too, has been at fault and that part of the betterment of condition must come from his greater push of engines than heretofore.

If this paper helps in any degree towards the putting of gas engines into the position that I believe they should hold, I shall feel well repaid for its preparation.

Discussion.

The President—You have listened to the reading of a very carefully prepared paper. The preparation of a paper of this character requires an immense amount of work. The paper is an exceedingly valuable one, not only for discussion but for future reference. It seems to me it is on the same line as the admirable paper on Gas Coals,[2] prepared by

1. American Gas Light Journal, Nov. 16, 1878, p. 225.
2. See American Gas Light Journal, Dec. 1, 1890, p. 761.

Mr. Adams, and which is now a work of standard reference to us all. It will be published in our proceedings, and will be referred to, I am confident, by every member of this Association where the installing of a gas motor can possibly be made. Mr. Shelton is ready to answer any questions on his paper.

Mr. McCullough—On pages 8–13 Mr. Shelton refers to the matter of self-starting gas engines. In a works with which I am connected we have an electric plant in connection with the gas works, which plant is run partly by steam and partly by a very large gas engine. I should say in advance that the two engines are not required during the entire time. The plant is started with the steam engine, and when the consumption gets up to the maximum the gas engine is started and run till the load decreases, then the gas engine is stopped and the steam engine finishes up the work. The question came up—in view of the fact that the fuel required for the gas engine is only used for a moment, when the engine starts, and the moment it shuts down its use ceases—why not start the gas engine first and then take up the increased consumption with the steam engine, till the load again decreases, and then let the fires be banked until the time comes to start it up again. The reply was that the gas engine cannot start unless it has something to help it. In other words, the steam engine is started first, and that will start up the gas engine. I then asked if there was no way that could be avoided, and the answer was, "No; unless a small gas engine is put in to start the large engine." Then I said, "How will you start that?" The reply was, "Start that by hand, and that will start the large engine." Mr. Shelton refers on those pages to a self-starting engine. I would like to ask him what a self starting gas engine is. I have no doubt others have had the same experience, and that information will be of very great value to many of us; for an objection made to the introduction of large gas engines is that they cannot be started by hand, but must have something to start them. It seems to me to be going back to elementary principles to have a series of motors employed to start a large one.

The President—Mr. Shelton will answer that later in connection with any other questions that may be asked.

Mr. Egner—I think Mr. Shelton is right about the gas men being somewhat at fault. I would like to relate some of my own experience in that respect. About four years ago the company with which I was connected decided to put in an electric light plant, and at that time I recommended them to use a gas engine, for I knew it was the cheapest. I had worked the thing out and knew it would be the best thing for the company to do. The president of the company was not a gas man, and I had hard work to get him to listen to me at all on anything of that kind. Finally we put in a steam engine. It has been a loss. It was a loss while I was there, and I have heard that it has not been so very successful since. It was not as successful as it was at first claimed They claimed to get 1-horse power out of 1½ lbs. of coal, but I do not think they ever did. I had a plan and blue prints made to put in a gas engine, and it would have been a success; but I was not listened to. The man whose duty it was to advise them on such a point was not even asked for advice, and was considered officious if he tried to give advice. The real fault was that the president of the gas company was not a gas man. I have recently been in a town in which they have two large gas engines and a complete electric lighting plant standing idle, while in another part of the town they run a steam engine to drive the electric plant. The reason of that is that the men who own the company and run it are not gas men. They have gas works, but they are not gas men.

Mr. McCullough—I would like to ask another question. Having recently had occasion to put up an engine, I put in a 40-horse power tubular boiler to drive the engine, and the cost of putting up the boilers, with their stacks and connections, and all that business, was $1,350. The wages of the bricklayers in putting up the foundation and setting the brickwork was $325, and the bricks cost $220. So that it cost $1,925 to put up the boilers. It was not a new engine, but it cost about $600. As I figured it up, the total cost of putting in this engine was about $2,700. I would like Mr. Shelton to state, if he can, what a gas engine of 80-horse power would cost?

Mr. Shelton—In regard to the specific cost of engines, I will say that I am entirely unable to give it offhand. There were so many figures involved in the preparation of this paper, and in endeavoring to cover the different points that I have tried to cover, that I simply had to give up at once the question of taking up specific, absolute and exact figures. But, taking it on the matter of general line, I would say that my conclusion was that, as a rule, there was a difference of 2 or 2½ or 3 times between gas engines and steam engines—which as a rule would more than pay even for the boiler plant. I cannot give a direct answer to Mr. McCullough's question without knowing all the conditions. In reply to the question as to self starters, I will say that what is known as a self-starter is now, in connection with good sized gas engines, an integral part of the gas engine proper; it is common to every shop. It is the feature of it which provides for starting the engine when entirely at rest, and even with 50, 60, or 75 per cent. of the load thrown on the engine, the whole thing being at rest. You can at once see the advantage of having such a thing, as against needing a small engine, a donkey, or four men and a boy to start the engine that Mr. McCullough speaks of. On this side of the water self starting devices are not used very much. I might say, first, that it is in various forms, and in various arrangements, but the principle is simple—that of storing a small portion of its enclosed mixture, which can be admitted by hand by opening a cock behind the piston (which may be at a quarter or half stroke out from the cylinder), and then igniting it by hand—not automatically, but by the control of the person starting the engine—and thereby obtaining a starting impulse to start the wheel one revolution, which by that time is then thrown into gear by the attendant, so that during that revolution all the functions of the engine commence. The first impulse of this small proportion of inclosed mixture is to start the engine on through this chain of events to its regular run. The feature has been quite successful on the other side, and has been, I think, incorporated in half a dozen different forms of engine. You can almost see the necessity for it when I say that one of the engines referred to in the last part of the appendix is a 300 horse power engine with a single cylinder. Those of us who know what 100 horse power is, know that we cannot start it by hand, but would have to have some mechanical device of that sort. All those who are interested in the subject may refer to *Cassier's Magazine* for either September or October, where will be found a detailed description of self-starters. They will also find it in Robinson's work, mentioned in the paper. On this side of the water the Otto people tell me that as a rule they have applied self-starters to a very limited extent, so far. As certain castings would have to be made specially for it, I question if any existing engine could be fitted with the self-starting appliance without a considerable expense for the alteration.

Telegrams and Letters.

The President—The Association is very much obliged to you, Mr. Shelton, and through me extends its thanks to you for your very valuable contribution. I have received the following telegram, addressed to the Association:

"*To the President of the American Gas Light Association:*

"Leaving America this week, and regretting that I cannot attend your current meeting, I offer my best wishes for the prosperity and fraternal relations of your Society and ours.

"Dr. H. Bunte, Secretary German Association Gas Engineers."

I have also received a letter from our good friend, Mr. A. B. Slater, of Providence, R. I., addressed to me as President of the Association. (Reads.)

"It is with sincere regret that I am compelled to forego the pleasure of meeting you and the members of the Association at the 21st Annual Meeting in Chicago this week. I believe it is the first time since I have been a member of the Association that I have failed to respond to the roll call. One of my principal assistants has been ill for more than a month and will not probably be able to attend to his business for some weeks to come. The work in his department is pressing at this season of the year, and as I have no one to take his place I feel that it is necessary to be here to attend to it myself. I regret my inability to be with you all the more keenly as I always look forward to the meetings of the American Gas Light Association with deep interest and pleasure, and I shall miss the warm grasp of the hand and the hearty greetings of my many friends, especially among the older members whom I have had the good fortune to meet at these meetings for so many years. To all the members I tender my warm regards and best wishes for their personal prosperity and happiness. Hoping that the 21st Annual Meeting will be second to none in interest and pleasure, I am, sincerely yours,

"A. B. Slater."

I have also a personal letter of regret at not being able to attend the Association meeting from our Vice President, Mr. Walton Clark. He is detained by sickness in his family. I have also a letter from Mr. Henry Boardman, of Bangor, Maine, expressing his regrets at not being able to meet with you here. The Secretary is also just in receipt of this letter from Pawtucket, R. I.:

"Dear Sir: Owing to my long continued and severe illness I shall not be able to be present at the meeting on the 18th, much to my regret. Remember me kindly to the President, and I hope you will have a good meeting. Fraternally yours, S. G. Stiness."

REPORT OF FINANCE COMMITTEE.

The President—I will ask if the Finance Committee is present and ready to report, as we would like to have their report as to the condition of the Treasurer's books and vouchers.

Mr. C. J. R. Humphreys—I am not the Chairman, but the Chairman has asked me to read the report:

CHICAGO, ILLS., October 17th, 1893.

To the Council: Your Finance Committee has examined the books and vouchers of the Secretary and Treasurer, A. B. Slater, Jr., for the year ending Sept. 30th, 1893, and found the same to be correct.

C. J. R. HUMPHREYS,
E. G. COWDERY,
A. W. LITTLETON,
} Finance Committee.

The President—You have heard the report of the Finance Committee stating that the books and vouchers are all correct. As the report was passed conditionally upon being so found, no further action is necessary, and the report of the Treasurer will therefore be accepted. I have another communication to present:

"Members of the American Gas Light Association desiring to visit the Cicero gas works are invited to do so at any time during their stay in Chicago. Railroad transportation will be furnished to and from the gas works, also a pass through the works, upon application at the office of the National Gas and Water Company, Room 522, 218 La Salle street, Chicago. Train leaves Wisconsin Central Station depot 1:30 P. M., via Chicago and Northern Pacific Railroad, returning to the city at 5 o'clock same evening. Gas works located at Austin Park station."

Any member desiring to visit those works (which will be a matter of interest, I can assure you), can do so by following the directions. I will take occasion to thank the officers of the Cicero gas works in the name of the Association for their very kind invitation. I have also a communication from the Bankers' Convention, which is, I think, now in session in this city.

"Suggested preamble and Resolutions for the American Gas Light Association:

"*Whereas*, The American Bankers' Association, at its 19th Annual Convention, adopted a preamble and resolutions, of which the following is a copy; and

"*Whereas*, The American Gas Light Association, in its 21st Annual Convention assembled, desires to co-operate with the American Bankers' Association for the attainment of the objects above set forth;

"*Be It Resolved—First:* That a Special Committee consisting of one member from each State be appointed by the Executive Committee from the membership of this Association, for the purpose of co operating with the American Bankers' Association to effect the organization of a National Monetary Commission that shall be a representative body to act for the industrial, commercial and financial interests of the whole people, for the purpose of considering, formulating and reporting for adoption by Congress and the Legislatures of the several States a sound American currency and banking system.

"Second: That said Committee is hereby authorized and directed to act in the name of this Association in all matters pertaining to this subject, and to report its actions to the Association or to its Executive Committee whenever requested to do so by the Association or by its Executive Committee."

These resolutions were handed to us with a request that they be presented for any action that might be thought necessary. There is a voluminous document also attached in regard to what is necessary for a sound financial monetary system of banking, and also suggested preambles and resolutions for the American Bankers' Association, to be passed in connection with those suggested for ourselves. With the reminder to this Association that there are probably as many divergent views on what constitutes a sound finance and banking system as there are members present, and that we do not ourselves expect, except as individuals, to influence legislation upon such subjects—having all that we can do to influence legislation in our own favor upon our own particular lines—I would ask you what disposition shall be made of this communication.

Mr. Floyd—I move that a special committee be appointed at once by the Chair to look into this matter and give at once a decided answer. It is a gentlemanly communication, and ought to receive a gentlemanly answer at once, and while this convention is in session. We all want sound money. The people want it. We want it as much as anyone else. We are all very much interested in the financial question which is agitating the country at the present time, and whatever this Association proposes to do I think ought to be done at once. Therefore, I think it would be well for the Chair to appoint a special committee to take the matter up and give the gentlemen an answer to their communication while they are still here in session.

Mr. Egner—I second it.

Mr. A. C. Humphreys—I would like to ask if this body is in session at the present time, and how long it will be in session; and also how much time is to be given to our committee to discuss such a very important subject?

The President—If there is anyone present who can give us information on this subject we shall be pleased to hear from him. I understand that they will be in session to morrow.

Mr. Jenkins—I really think the American Bankers' Association do not understand the purposes and objects of this Association. We are here, as I understand it, as a body of engineers, and not as the financiers of our different companies. I think, perhaps, the Bankers' Association have understood, or rather imagined, that we happen to be the financiers of our companies, and that is why they ask this co operation from us. As a matter of fact, we do not as a rule represent our companies in any such way, and I think if they were given to understand the facts plainly the matter will be quickly and properly disposed of.

The President—It seems to me all we could possibly do would be to empower a committee to explain to the American Bankers' Association that this Association is not a financial body, and it could do no more than express individual views in the matter, and which views would probably vastly differ.

Mr. Floyd—As there seems to be no time to answer this communication through a committee, I would move that the Secretary be instructed to answer the communication, and state why this Association does not take action in the manner suggested at the present time.

The President—That seems to me to be the best course. The substitute, therefore, is that the Secretary be empowered to reply to this communication from the American Bankers' Association, and explain to them why we cannot take action pro or con on the subject of this resolution. As the substitute motion seems to be satisfactory both to the mover of the original motion and the seconder, I will therefore put it as an original motion, that the Secretary be directed to answer this communication and respectfully explain to the Bankers' Association why we cannot act on the line therein indicated. All in favor of that motion will signify it by saying, "Aye;" contrary minded, "No." It is carried.

THE QUESTION BOX.

The President—The next business in order is the Question Box. In looking over the questions in the box I find that in quite a number of instances two or more questions pertain to the same subject; and it is probable that, with slight modification, the same answer might cover both. I will, therefore, present as one question any two questions which pertain to the same subject. The first two are of that character:

"1. Can anyone give any information concerning prepayment meters, such as are now somewhat largely used in Europe?"

"2. Have any experiments been made in that direction in this country? Do any of the American manufacturers make same?"

The Chair waits for a response.

Mr. A. C. Humphreys—As no one seems to be able give a very specific answer to the question, I will say that I can give you a little information as to what is done on the other side in respect to prepayment meters. The Liverpool Gas Company manufactures its own meters. Mr. King, the Chief Engineer of the Company, did not personally believe in the scheme, but there were others in the Board of Direction who believed in it, and who wished to give it a trial. They gave it a trial, and I understood Mr. King to say that it was quite successful, and they are growing quite rapidly in favor. They now have a very large number of prepayment meters out. We know that Mr. Ballou is also working largely in that direction, and claims to have made a great success of it.

The President—Are there any meter makers represented here who are either making such meters now or proposing to make them shortly?

Mr. A. C. Humphreys—I would like to add that Commissioner Barker is able to confirm my impression. I did not like to give a definite statement from memory, but he agrees with me that Mr. King had out some 4,000 prepayment meters some months ago.

The President—There is evidently very little experience with their use on this side of the water.

"3. What can be said for and against the use of gas heating stoves which are not connected with a flue, such as the Backus heater and the perforated stoves made by Crane & Co., of New York, and Geo. M. Clark & Co., of Chicago? Also, of the various forms of radiator stove manufactured by the various concerns and operated on the above principle?"

What can be said for or against the use of gas-heating stoves not connected with a flue?

Mr. Littlehales—A celebrated piece of advice was once given by *Punch* to those about to be married—"Don't." So I would say with reference to all stoves, the products of combustion from which go into the room in which they are placed. I would say to all those contemplating their introduction, "Don't." I do not think that any stove can be fixed in any room of any size where there is no connection with a flue, without the products of combustion going into the room. I have made it an invariable rule to recommend against doing that. I always recommend against letting the products of combustion go into the room.

Mr. Butterworth—I would like to ask Mr. Littlehales if he has had any experience with the Backus heater?

Mr. Littlehales—I have seen a number of them at work, and the same objection applies to them—that the products of combustion necessarily go into the room; and I care not what the form of heater may be, or what the maker may say, it is the same principle. I object to having carbonic acid delivered into the room.

Mr. Butterworth—Do not the products of combustion go into the room when we use gas in the ordinary manner, through jets, for lighting purposes?

Mr. Littlehales—That is true, but two wrongs do not make one right. I would like to get rid of that also; but as I cannot get rid of that I do not propose to add to it.

The President—The next question is also in two parts:

"4. Can any member or members give any information resulting from practical experience as to the operation of electric light plants by the use of gas engines, with reference to both arc and incandescent lighting?"

"5. What are the weak points of the system?"

There seems to be no answer.

"6. At what relative prices (per barrel and chaldron) can tar be economically substituted for coke in firing benches when coke is in good demand?"

"7. How many gallons of tar are required, in practice, to carbonize 2,000 pounds of coal?"

Those two questions might also be considered together.

Mr. Egner—I would say I have found in my experience that one gallon of tar was equal to two thirds of a bushel of coke. That is the average for many weeks or months of constant working—that one gallon of tar is equal to two-thirds of a bushel of coke. That is as near as I can give it to you now.

The President—I think that answers the question, because every member can find out from the price of coal in his own locality at what point it would be economical to use coke or tar.

Mr. Littlehales—With reference to that, I will say last winter we made considerable use of tar for fuel and found it took 2 barrels of tar every 24 hours to heat a bed of 6 retorts. The same bench took 36 bushels of coke in 24 hours. So that 2 barrels of tar compare with 36 bushels of coke, and each one in his own locality can figure that out.

Mr. Egner—What is the size of your barrel?

Mr. Littlehales—The ordinary 40 gallon barrel.

The President—The next question is:

"8. Is it good policy for a gas company to go into the gas fitting and fixture business, to thereby secure the best results with the least cost to the consumer?"

Mr. Jenkins—I think that question is to be decided entirely by the size of the company and the local conditions.

The President—I think so. The next two questions may also be grouped:

"9. Have any of the members had any special experience with the effects on gas mains and services of electric currents used by street railways, and if so, what?

"10. What action can be and should be taken by gas companies for self-protection in the above mentioned matter?"

There evidently has been some trouble. I think that Mr. Chollar has had some experience in that line.

Mr. Lynn—I have had some little experience of that kind in Memphis. I found that there was no trolley system with a ground wire or rail, but found a service pipe running into a church there, and the thing had been used probably a year before. There were perforations and holes right under the track, and probably for 18 inches on each side of the track, but from there into the church the service pipe was comparatively in good order and condition.

Mr. Butterworth—In answer to the 10th question: "What action can be and should be taken by gas companies for self-protection?" I have one suggestion to make which I do not want the members to regard as being insincere, and that is that I would, if necessary, offer to a street car company, before it installed its electric trolley system, a bonus to locate their power house near the water works, or at least near a large water works pipe, and let the current follow the water main. I think that would prevent the injury to our gas pipes, by making the water pipes receive and carry the return current from the street back to the power house, instead of through the gas pipe.

The President—I do not think that it is where gas pipes are used as conductors, but where the current passes through them from the ground to the wires. The induced currents are probably more at fault than the direct currents, and the injuries occur more likely where there is no actual contact, but where the services cross the runaways of the electric current. I do not think it would make much difference to connect with the water mains instead of with the gas mains.

Mr. Butterworth—In my six years' experience at Columbus we have had no trouble with the trolley, or at least none that I have discovered, and I think that elsewhere where similar conditions exist all trouble can be prevented. I think the explanation can be found in that way—that the water pipes of the city are the natural passages for the return of the current back to the power house. The current must get back to the power house in some way, and it always follows the line of least resistance, which is the water works pipe.

Mr. Thompson—I think if more members would speak it would be found that the experience of difficulty resulting from the use of the trolley has been quite general. In England there has been a Parliamentary committee appointed to consider the matter, and I think that their recommendation is about the only way to remedy it thoroughly—and that was to have the street car company construct metallic circuits. The New England and the Western Gas Associations have appointed committees to consider this subject and report at their respective meetings next year, and I think it would be well to appoint a similar committee in this Association.

Mr. Egner—The reconducting of the current back to the power house by means of a metallic circuit of rails is only a pretence. The rails are connected by wires, and it is pretended that the current is reconducted; but the earth itself is a great magnet, and that current will go into the earth quicker than it will return through a metallic conductor to the power house. But it is a well known fact that the current will go to the earth—the direction of it is towards the center of the earth. It is not perhaps so generally known that street car companies connect every gas and water pipe they can on their route—which at once shows that carrying the current back to the power house is all pretence.

Mr. Littlehales—It strikes me that the suggestion of Mr. Butterworth is simply a removal of the load from the shoulder of the gas company to that of the water works company.

Mr. Butterworth—I call it that.

Mr. Littlehales—But here comes the difficulty. In making a repair, or taking out a piece of main, your men will have to make the connections at the risk of life, because as soon as the connection is broken there would be a great risk. In our city there has been a good deal of trouble with the water works themselves. As soon as the gas company discovered that there was any injury going on in the pipes they took the precaution in those sections where the iron posts are up of making an examination and moving every service, so as to give a sufficient distance between the trolley poles and the pipes, so that the current would not come in contact with our services. Since then we have had no injury whatever. A great many water works services have not been removed. I think it would be well in every case to remove the services where they are near the trolley pole.

The President—This is a very important matter for the Association, and I am glad it has been so thoroughly discussed. It seems to me that a little coercion in making the electric people pay for the injuries to gas pipes would have a good deterrent effect. If any repairs to our services are needed by reason of electrolysis, I think they ought to be made to make them.

"11. Why are electric light annexes to gas works in most cases so unprofitable?"

There is an assertion in that question.

Mr. Pratt—That might be answered by saying that electric light annexes to gas works are able to show a profit to the same extent as are companies which are operating only electric lights.

The President—I think that perhaps it is a matter of bookkeeping.

Mr. Pratt—Usually.

The President—The next two questions may be grouped together:

"12. What kind of material gives best results in superheaters for fix-

ing gas in cupola system—say 'Granger-Collins' machine; and has any member data showing the cost, per thousand cubic feet of gas made, for this material?"

"13. In experimenting with anthracite coal used in the manufacture of water gas by the Granger-Collins machines, what kind has been found to give best results under conditions used, and how many pounds necessary per 1,000 cubic feet of gas made—*i. e.*, has any member facts, with data, bearing on this subject."

Evidently no one has the data at hand to answer with any degree of accuracy.

Mr. Shelton—To expedite matters and to clear the docket I will say I do not think anything has been found which is better for superheater material than good, old-fashioned 9-inch firebrick. Any quantity of substances have been used on trial, but in nearly every case they broke. As to the cost per 1,000 feet, I may say it usually is incorporated with the cost of firebrick lining for the generator; so that the cost for firebrick repairs is made up in the aggregate of new filling brick and new lining brick, and they are rarely separated half and half. I think it would be impossible to ascertain that in specific instances; you have to take them side by side. To the 13th question I think the answer is that anthracite coal is worth as much in a water gas generator as in any other process of manufacture. As to the amount of materials used per 1,000 feet, it is impossible to state that without knowing the size of the machine, the amount of gas made per day, the number of hours in operation, and other data.

Mr. Pinckney—I do not see but that it is perfectly practicable to find out how much superheated material exists in a superheater without knowing the cubic feet. For instance, we do not reline (or at least I do not) my superheater once in five years, but I do replace the superheater materials five, or perhaps ten times. Therefore, taking the date of introduction of new superheater material as the standpoint, and then taking the date at which that is dead, so that it is absolutely of no further use, and will not retain the heats, and is perfectly saturated, then finding out the quantity of gas made from the date it was put in until it is taken out, and then dividing it into the cost of the brick, you have beyond question the cost per 1,000 cubic feet for superheating material. The point which is, I suppose, designed to be covered by that question is to get the experience of various gentlemen using the cupola system, to see if there has not been some special brick prepared which will resist this saturation, and at the same time prolong the life of the brick, and retain the heat. That, I presume, is the point of the question.

The President—Has any member information on that point—whether there is any one brick which is superior to another; or whether there is any particular material better than brick? There seems to be no data at hand to enable a satisfactory reply to be made to that question. The next question is:

"14. What is the present cost of cooking and heating with electricity as compared with gas, and is there any likelihood that electricity will become a successful competitor of gas for these purposes?"

Have any members any data upon that question?

Mr. Butterworth—I will make a statement, and will give my reason for making it. Cooking and heating by electricity is as cheap as cooking and heating with gas, with gas at $1 per 1,000. My authority for the statement is the gentleman who is doing the electric cooking on the Fair grounds. He told me that yesterday.

The President—Do you think that it will become successful, and be as economical as cooking by gas?

Mr. Butterworth—He said that it would, at that price.

The President—The next question is:

"15. What is the usual practice as to cleaning up stocks of coal and coke? How much of a difference from original weights is permissible?"

I think that the different classes of coals in different locations of the country have a great deal of effect as to what is permissible and as to what percentage you have to charge off after your coal house is emptied, from what your retorts show you have used.

Mr. Somerville—My opinion is that it is about 2 per cent.

The President—"16. At what point in the comparative values of coal and coke is the limit at which it is economical to adopt regenerative furnaces?"

There seems to be no answer to that.

"17. In an apparatus for making carbureted water gas, to what degree should naphtha be preheated before admission? Crude oil?"

Can Mr. Humphreys give us any information on that question?

Mr. A. C. Humphreys—I think not.

The President—There seems to be no answer to that question.

"18. With a generator using anthracite coal, what are the best proportions and durations for times of blast and run? What lengths of time when using coke?"

That is also a question on which the doctors disagree.

"19. What is the effect on the production of ammonia by a change from direct firing to regenerative benches? What the reduction in production of tar?"

Has anyone figured that out?

"20. Is there any increase or decrease in deposition of napthaline in purifier boxes when admitting air for revivification *in situ*?"

Mr. Pearson, did you find any difference in the amount of naphthaline deposited when revivifying *in situ* and when taking it out of the purifier? Was there more or less naphthaline deposited in the boxes when you admitted air for revivification *in situ*?

Mr. Pearson—We do not admit air at all. I did not understand the question.

The President—Have any of the members found any appreciable change? It seems not, as no one answers. The regular order of business has now been gone through with. Is there any new business?

I hope the members of the Association who have indicated in any manner that they would join in the banquet will secure their tickets at once, because it was upon their say-so that the banquet has been prepared, and the expense will fall quite heavily upon individuals unless the number of tickets guaranteed is taken. We are trying the experiment of having a banquet and paying for it ourselves. It is an experiment which, as the Association comes of age to day, we ought to make a success. I hope that the members will feel enough interest in the Association, and in that feature of it—the convivial feature, the friendly feature—to come forward and take their tickets promptly.

There is a question which was handed in, but which has been misplaced, so that the exact wording cannot be given, but it is to this effect: "What is the advantage from different grades of naphtha to be used in the manufacture of water gas more than the mere price of the different grades per gallon? Is there an advantage in the different grades more than that, or is there not?"

Mr. Pearson—I do not quite catch your question.

The President—The question is, Is there an advantage in using a high grade over a low grade of specific gravity of naphtha more than the difference in price per gallon?

Mr. Pearson—I can speak with reference to high and low grades of gas oil. We have not sufficient gas naphtha to supply the gas companies, and so we make our gas from what is called gas oil. We use gas oil of 35 gravity and find that we get quite as good results in illuminating power and better results as to amount of gas made with oil of 35 gravity than we do with 40 gravity.

The President—What is the difference in cost?

Mr. Pearson—The difference in cost is very trifling—not more than 10 cents per barrel.

The President—Is there any other business before the Association?

Mr. Somerville—If you will pardon me—it seems to me that some of us ought to be able to answer question 19:

"What is the effect of the production of ammonia by a change from direct firing to regenerative benches? What the reduction in production of tar?"

I suppose that the man who put in this question has noticed a certain increase of temperature in the regenerative benches, and no doubt he has noticed that with that increase of temperature there is a reduction in his tar. I would say that so far as the tar is concerned there would be a reduction in the amount of tar made in consequence of the increase of heats in the regenerative benches. And, as to the ammonia, my answer would be that I have found that the ammonia also increased by increased temperature.

The President—A motion to adjourn is now in order, but before putting it I wish to thank you all for your very kind attention to the business, thus enabling me to get through with it rapidly, and to thank the officers who have been so instrumental in making a success of this meeting.

Mr. Miller—I would ask whether there is to be a meeting to-morrow?

The President—If we adjourn now we adjourn *sine die*.

Mr. Egner—If we do adjourn now this will be the first meeting I have ever attended at which the officers did not get a vote of thanks. Before we adjourn I want to move a vote of thanks to you, Mr. President, for the manner in which you have expedited our business; and also to the Secretary.

Mr. Somerville—I second the motion.

The President—It is moved and seconded that a vote of thanks be given to the officers for the very able and efficient manner in which they have conducted this meeting, and for the rapid manner in which they have gone through with the business. All in favor of that will say, "Aye." (Adopted.)

On motion, the convention was declared adjourned.

On the Artificial Production of Petroleum.

BY DR. C. ENGLER.

Scientists have discussed very often in the last few years the question in which way petroleum, this source of wealth, with its special scientific interest for this country, was formed by nature. According to one theory it is generated from inorganic materials. Sokoloff thinks that petroleum was produced during the period of the formation of our planet out of cosmical hydrocarbons, which in the beginning dissolved in the soft mass, separated from it later on. Mendelejeff assumes that water entering by fissures and chasms the interior of the earth came in contact with melting carbide of iron and produced so in a simple manner oxide of iron and the hydrocarbons of petroleum. Strong objection cannot be made to these two theories from the chemical standpoint; but the composition of the different kinds of petroleum is against them, and geology considers them not free from objections.

For a series of years the idea that petroleum was produced from the remains of plants by a kind of a distillation process was most generally adopted, especially by chemists. Chemical and geological reasons are against this theory. From the chemical standpoint it seems quite impossible that the substance of the plants could be split up by distillation into petroleum without leaving charcoal or coke. There would also be a genetic connection between coal and petroleum; but in occurrences of the ordinary kind coal is nearly always absent. If this were really the case, then there ought to be with every oil occurrence in close connection a coal bank, which really seldom happens.

By a third theory the remains of animals form the raw materials from which petroleum is formed in nature. There are many facts proving the decay of masses of animals which we find now in banks in the crust of the earth in the form of the remains of shells, fishes, saurians, etc. Prominent scientists, amongst them the Americans, Wrigley, Whitney, Hunt and others, and in Europe, Hofer and Ochsenius especially, defend this idea on geological grounds. But I will not enter into the geological discussion, preferring to try to give an answer to the question: How can the transmutation of animal remains into oil be imagined?

In order to answer this some thousands of salt water fishes and also shells have been distilled under strong pressure. The result was a liquid containing mostly nitrogenous bases, such as pyridin, which was little or not at all similar to petroleum. I then recalled some experiments of Wetherill and Gregory, who found that the wax found in cadavers, the so-called "Adipocere," was nothing else but the fatty residue which remains after the putrefaction of all other animal matter, especially of the nitrogenous constituents of the cadaver. It is also well known that even fossil bones frequently contain fat. The question now raised was this: Could not the process in nature have been a similar one; should not first of all the nitrogenated animal substance have been destroyed leaving the fat, which was then transformed into oil. In order to prove chemically this possibility, I submitted animal fat (train oil) to distillation—first in a sealed glass tube, later on in a large iron vessel—under a pressure of 25 atmospheres at a moderate heat (300–400° C.), and to my great delight found that under favorable conditions 70 per cent. of the train oil was transformed into petroleum. This equals 90 per cent. of the theoretical output. Besides the oil some water and some combustible gas was always formed. The same behavior has been shown by other fats like butter, the fat of hogs, artificial fats, also the chemically pure glycerids of the fats like tri olein, tri-stearin and the free fatty acids. All could be transformed into petroleum by distillation under pressure, when managed in the proper way.

This liquid, which you see here, is the distillate of the fish oil, and I have isolated from it almost all the hydrocarbons which have been discovered in the petroleum of Pennsylvania. The other products—the oil burning in this small lamp, too—are oils obtained from the crude material by purification.

But not only illuminating oils are produced. I separated also by distillation those lighter hydrocarbons which compose the gasoline, the ligroin, the benzine, etc. Recently I have succeeded in finding and separating paraffine wax and lubricating oils from those parts of the crude oil which show a high boiling point. This removes the objection of O. Ross to my theory of the formation of petroleum from animal remains. As a matter of fact I have found in the distillate obtained by decomposition of train oil nearly all the constituents which have been separated from the natural crude petroleum, and even the gases, which, like natural gas, consist essentially of marsh gas.

Very recently I have made close investigations on the mechanism or on the chemism of the formation of the hydrocarbons of the petroleum produced by distillation of fat under pressure. This paper is published in a recent number of the *Berichte der Deutschen Chemischen Gesellschaft*, 1893, 26, 1436. These experiments prove that the simpler organic acids split up in the same way, yielding almost the theoretical quantity of the respective hydrocarbon. Thus phenylacetic acid yields toluene. For further details I am obliged to refer to the paper itself. I need only remark that we have to assume that the acids with high molecular weights are decomposed with the production of a number of hydrocarbons.

To recapitulate, it is a geological fact that we find in nature the remains of antediluvian animals as shells, fishes, saurians accumulated in masses. Whether these animals have been piled up in consequence of a natural super production in special places in the ocean, or by currents, or in consequence of great revolutions of the earth, this must be decided by geology; but the remains exist.

Now in which manner do the organic substances of these animals become decomposed?

The animal substance consists essentially of nitrogenated material and fat. The former is easily decomposed, the latter is very stable, a fact which has been very well known for a long time and has been shown again by exact investigations. Therefore we find the wax of cadavers in old graves; therefore the fat in the bones of mammals thousands of years old; therefore the fat on the bottom of the ocean recently found.

Whether and how far the fat was decomposed in this long period by the water splitting up glycerol and forming the free acid, for instance the fat in the bones of mammals, cannot be answered. Both, fat as well as the fatty acids from petroleum, when distilled under pressure.

We can imagine, that such remains wrapped in mud and transported by the currents in the ocean, easily accumulate and later on, under the pressure of sedimentary layers or strata, perhaps under the influence of heat too, are transformed into petroleum. This is only one of the many possibilities by which the mechanical process of the transmutation of fat into petroleum may have happened.

Under any circumstances I think I have proven that from the chemical standpoint, the formation of petroleum from animal remains has the greatest probability, as we are able now to transform every animal fat into petroleum.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

ON the last Saturday in October the people of Middleboro, Mass., held a special election for the purpose of determining whether or not the Middleboro Gas and Electric Company's plants should be purchased and operated hereafter on municipal account. The project was endorsed by a vote of 601 to 116, and it was directed that the price to be paid should not be in excess of $63,000. It was also voted to raise the necessary money by an issue of bonds amounting to $75,000, the same to be redeemed in series running from 1 to 30 years.

MR. H. T. SHAEFER has petitioned the Selectmen of Winchester, Mass., for the right to construct and operate a gas works in that town, and there is little doubt that he will be granted the necessary franchise. He agrees to construct a works equal to the manufacture of 100,000 cubic feet per diem, and the maximum sales rate per 1,000 is not to exceed $1. Winchester is a post village in a similarly named township of Middlesex County, Mass., and it is on the old Boston, Lowell & Nashua Railroad, where the latter is crossed by the tracks of that road's Woburn branch. It is eight miles northwest of Boston, and is a lively, growing place, noted for its manufactures of leather. Population about 6,200.

THE proprietors of the Long Branch (N. J.) Gas Light Company will reduce the selling rate to $1.75 per 1,000 cubic feet.

A CORRESPONDENT at Port Jervis, N. Y., writes: "I read in the JOURNAL sometime ago a brief intimation to the effect that Warwick, N. Y., was considering the advisability of granting to the National Light and Construction Company the right to build a gas works there, and I am in a position to say to say that the Village Trustees have voted to accept the proposition. The village has agreed to give to the company a contract for the public lighting, under which 75 lamps will be maintained at an annual rate not in excess of that charged for the kerosene

lamps now in use—about $26 per lamp per annum. The finest globes and posts will be put up, and the village has an option on the whole plant at the expiration of the franchise, which is to run for five years, though no obligationto take it then is assumed. The company will work under the system of manufacture in vogue at Stoughton, Mass., and the composition of the gas that will be distributed is said to be as follows, although I am disposed to believe that the analysis is a defective one:

Illuminants	39.08 per cent.
Marsh gas	55.57 "
Hydrogen	4.61 "
Carbonic oxide	.00 "
Nitrogen	.41 "
Oxygen	.07 "
Carbonic acid	.26 "
	100 "

It is understood that construction work will be commenced at once and that it will be pushed to speedy completion.—A. F."

At a special meeting of the City Council of Topeka, Kansas, a feature of the proceedings was the introduction, by Colonel Burgess, of an ordinance granting the use of the streets and alleys for the purpose of laying gas mains to the projectors of the Great Western Fuel and Gas Light Company, of Chicago. A franchise to last for 21 years is asked for, on the stipulation that no higher rate than $1.50 per 1,000 for illuminating gas is to be asked, and that the rate for gas used as fuel shall not exceed $1.25. The rate to the city is not to exceed $1.25 per 1,000. The Company asks to be given one year after the passage of the ordinance in which to begin work, and promises to build the plant and lay at least one mile of mains inside the city within 18 months after the taking effect of the ordinance. Colonel Burgess, who introduced the ordinance by request, says that the Company is backed by ample capital; but the whole affair has, to say the least, a very suspicious appearance.

The Connersville (Ind.) *News* says: "The local stockholders of the American Fuel Gas Company, of Harris process memory, have been notified by J. O. Lee, Secretary, of a meeting that is to be held at Frankfort, Ky., in the near future. It has been so long since anything has been heard from the Company that some people were of the opinion that it had withered and blown away."

The Chicago *Times* is responsible for the following: "Francisco Mugirra, a gentle and kindly man who believes in compromise rather than warfare and agitation, lived at 44 Polk street until he was removed to the county jail. While men of social prominence like Henry C. Rew engage themselves in prolonged litigation with large corporations, and social economists are discussing municipal ownership of all mains for lighting and heating a city, Franciso discarded theory and resorted to action. Being economically disposed, as well as inured to the warmth and brilliancy of the sunny skies of Italy, he combined all these characteristics of his benevolent nature, dug a hole from his home to the one adjoining, tapped the supply pipe of the Chicago Gas Light and Coke Company just under the meter, connected it with his own domestic system of illumination and calorification, and laughed at litigation and theory alike. When he had obtained his gas in this way he did not conceal his light under a bushel. With proper mechanical appliances he now fried the succulent onion, now popped the pleasing popcorn, anon roasted the odorous peanut, again stewed the lissome macaroni. Some say that on Fourth of July Francisco inflated balloons with the corporation's best gas and sent them heavenward to celebrate the occasion. Mugirra was a happy and prosperous man, fairly inflated with eleemosynary gas and increasing fortune when the Gas Company traced the leak. And that is why Francisco Mugirra looked like a little wanton boy, who had been swimming on a bladder, in the Criminal Court, when he pleaded guilty and was sentenced to a term in prison for stealing gas."

The Consumers' Gas Company, of Wilkes-Barre, Pa., will add another generator to its manufacturing plant.

The Tacoma Gas and Electric Company has been organized by Messrs. Edmond Rice, William H. Elliott, W. A. Rice and T. W. Enos for the purpose of purchasing the gas plant of the Tacoma (Wash.) Light and Water Company.

The hotel men of Cleveland, Ohio, are up in arms against the proposition of the local suppliers of electric light to insist on the meter principle in the supplying of light instead of the contract plan; for the Cleveland Hotel Men's Association held two meetings on October 27th to consider the probable effect of the introduction of the electric light meter into their establishments. The first was held at the Hollenden on the morning of the day mentioned, and all save two members of the Association were present. They discussed the proposed change in a general way, but could not come to anything like a conclusion as there was no exact data at hand. They decided to visit the offices of the Electric Light Company for the purpose of getting at the facts, and subsequently carried out that resolution. While they did not seem inclined to reveal what had been said at the conference, one member was prevailed on finally to make the following statement: "Nothing definite was discovered except that the Company announced its intention to put in meters as soon as it could. The officers did not deny that the cost would be greater, as I have all the time felt assured. They say they have something to sell, and they propose to get its value. We have been accustomed to burn the lights in our hotel 24 hours every day, and we never think of turning them off. They will burn as long that way as they will when turned on and off as needed. I have no doubt the meters will double the cost if the lamps are burned the same as now."

As a sequel to our former mention of the litigation concerning the Iowa City (Ia.) Gas Company, we may mention that on the 1st inst. President Clark, of the Company, received a notice from Judge Woolson, of the United States Court, ordering him to call a meeting of the stockholders of the Gas Company on Nov. 9 to elect three Directors to co operate with President Clark and Secretary Morrison, until the annual election in January.

The proprietors of the Jamaica (L. I.) Gas Light Company recently presented to each minister in the village a handsome bronze stand and argand burner, with the necessary tubing, to adorn the clerical library desk or reading table.

The artificial lighting of Waltham, Mass., by gas dates back to 1853. During the early part of that year several public spirited men petitioned the Legislature for a charter, which, being granted, the Waltham Gas Light Company became an incorporated body April 1, with a capital stock of $35,000. The first Board of Directors was composed of Messrs. Horatio Scott, R. S. Warren and Horatio Moore, and Mr. Thos. Page was chosen Clerk and Treasurer. A lot of land comprising about five acres was purchased near the river off Pine street. The first gasholder erected had a capacity of about 30,000 cubic feet, and the demand for gas was so great that a second soon followed. A third was added a few years later, and in 1880 the fourth and last was put in. The combined capacity of the four was 350,000 cubic feet. The plant as it stands today embraces the manufacturing building with eight benches of six retorts, the total capacity being 400,000 cubic feet per day. Other smaller buildings are adjacent, making an easily managed plant, located on one of the prettiest plots of land in Eastern Massachusetts, landscape gardening having materially aided to this end. The subject of electric lighting was first talked about here in 1886, but because of many differences of opinion it was thought the Gas Company would have a monopoly, and a company was formed for electric lighting, which was finally obliged to succumb to the older and more experienced before it was fully started. All rights having been transferred, the Company began work under the name of the Waltham Gas and Electric Company. A new building of brick, 48 by 70 feet, and two stories in height, was erected. Two Armington & Sims' 60-horse power engines, two 50 arc light and one 650 light incandescent Thomson-Houston dynamo machines were purchased, and on Christmas eve the first current was turned on. At that time there were only 19 arc street lights, and power was furnished from a 160-horse power boiler in the gas works. The demand for electricity was as great as the demand for gas 33 years previous, and only a few weeks elapsed before 25 commercial arc lights had been added and the number of street lights increased. In 1888 a 56-horse power straight line engine was put in, together with a third arc dynamo and a 1,500 incandescent alternator. A year later the plant was again increased by the erection of a building, a duplicate of the first. In the west end was a boiler room 48 feet by 38 feet, in which were placed three upright Manning boilers of 150-horse power each. In the adjoining portion of the building was located a 300-horse power compound condensing engine. About this time the Newton Street Railroad adopted electricity, which was furnished from Waltham, necessitating the addition of two 80-horse power generators. The pressure still continued, and two more 80 horse power generators were added; also a 60-light arc dynamo. Eighteen months later an annex was built, to which was transferred the original plant of three engines and three dynamos. The again crowded building made this step necessary, and to economize

space a second 300-horse power engine supplanted the three removed. Last summer two additional upright 150 horse power boilers were put up and the foundations laid for a third. At present there are in use 84 arc street lights and 80 commercial lights, with a dynamo equipment equal to the maintaining of 300. Incandescent dynamos supply power for 3,800 lights with a reserve force of 1,000. The total amount of boiler power equals 900 horse, that of the engines 760, and of the power generators 320. The present Board of Managers consists of Lowell Clark, President; George A. Stearns, Treasurer, Manager and Clerk of the corporation; A. M. Goodale, J. R. Farnum, William Roberts, A. T. Lyman and Augustus Flagg, Directors. Col. C. F. Spaulding is Superintendent, F. T. G. Hill is Electrician, and H. E. Priest is Clerk of the Company. The Company is capitalized in $140,000.

THE people of San Francisco propose to hold a "Midwinter Fair" in that city, which will have for its object the exhibiting of the many wonderful products of the State. Funds for the construction of the necessary buildings, etc., are now being subscribed, and prominent amongst the subscribers are the San Francisco Gas Company and the Pacific Gas Improvement Company, the former of which promises to contribute $2,500 and the latter $2,000 in gold coin.

A CORRESPONDENT at Spokane Falls, writing under date of October 27th, says: "The street lighting problem here grows interesting. At noon to-day the Edison Electric Illuminating Company had returned no answer to the Council's demand that all lights outside the fire limits be discontinued on November 1st, unless the monthly rate is reduced from $3 to $6 per lamp. In the meantime the Spokane Falls Gas Light Company seeks an opportunity to light the streets, four proposals for performing the work having been submitted to Mayor Powell by Mr. A. D. Hopper, the Secretary of the Company. They are based on a three years' contract for not less than 100 lights along the line of mains already laid, the Company to put up the posts, fit the lamps with 5 foot burners and paint the names of streets on every corner lamp. For not less than 100 lamps burning all night and every night, the proposed rate is $39.75 per lamp per year; every night, from dark to midnight, rate, $29.75; from one hour after the sun or moon sets the rate is $24.50; from one-half hour after the sun or moon sets, until midnight, the rate is $16.50. These rates are based on the expectation that the price of coal will be lower in the future, owing to competition in freight rates; and it is further known that at these figures there will not be any great margin of profit for the Company in the service. Members of the Council assert that these propositions will receive prompt and careful consideration, as, for instance, under the all night and every night proposal the city could put in twice as many gas lamps as there are electric lights and still save a balance of $16.50 on each light every year."

THE Turner and Seymour Manufacturing Company, of Torrington, Conn., having decided to build its new foundry of iron, has placed the contract with the Berlin Iron Bridge Company, of East Berlin, Conn. The old foundry was burned a short time ago, hence the Company's determination to build the new structure entirely of iron and brick, the side walls being of brick and the roof of iron. The roof will consist of iron trusses and iron purlins covered with the Berlin Iron Bridge Company's patent anti-condensation corrugated iron. When completed the building will contain no woodwork whatever except the frames and casings, so that it will be absolutely fireproof. The owners and constructors in any event are satisfied that the structure is in no danger from injury by fire, for the former will carry no insurance on it and the latter guarantees that if all the wooden flasks which the Company uses at any one time were piled in one place in the building and fired the roof would suffer no damage.

THE United States Circuit Court of Appeals for Philadelphia has affirmed the judgment of the District Court of New Jersey in the case of the Jersey City Gas Light Company against the United Gas Improvement Company, which finding was in favor of the last-named corporation. The case was based on the construction of the lease under which the United Gas Improvement Company operates the Jersey City Company, and had reference to the payment of taxes under the agreement.

THE National Gas Governor Manufacturing Company has been incorporated in Chicago by Messrs. Thos. Robinson, George M. Bixby and Gabriel B. Hughes. The capital is returned at $250,000.

THE Chelsea (Mass.) Board of Aldermen have given leave to the projectors of the Chelsea Gas, Fuel and Heating Company to withdraw its petition for permission to open the streets of the city to lay gas mains.

ON the application of the corporation of Cote St. Antoine, of Montreal, through its attorneys, Judge Pagneulo has issued the following order: "Inasmuch as on the 27th of October a writ of injunction was issued enjoining the defendant (the Montreal Gas Company) to suspend work upon or in the streets of Cote St. Antoine; inasmuch as the Montreal Gas Company refuses to obey the said writ and is now proceeding with the works ordered to be suspended and has illegally taken possession of another public street in the town of Cote St. Antoine, to wit, Elm avenue, and is now excavating therein for the purpose of laying pipes, We order the defendant to appear before this Court on the 2d of November to show cause why it should not be declared in contempt of this Court, and why it should not be sentenced to pay a fine of $2,000, and why all the works performed in defiance of the injunction should not be ordered to be destroyed and the streets replaced in their former condition, and why it should not be condemned to pay costs of these presents." We understand that when the case was called on the 2d inst. a continuance was agreed upon.

THE petition of Mayor Matthews for a reduction in the price of gas supplied by the Charlestown (Mass.) Gas Company was the subject of a public hearing before the Board of Gas and Electric Light Commissioners on the morning of Oct. 31. Several other petitions were presented from residents of Charlestown who are consumers of gas, also asking for the reduction. Corporation Counsel Babson appeared in behalf of the Mayor and the other petitioners, and a committee from the Charlestown Improvement Association, consisting of Messrs. Kelso, Gammans and Lincoln, also appeared. The Charlestown Gas Company was represented by Mr. Simon Davis. Mr. Babson made the opening address, and offered as part of the case certain testimony which had been given by George B. Neal, the Treasurer and Agent of the Company, that the cost of gas was between 45 and 46 cents, and also the testimony of Superintendent Coyle, that those figures were about right. He wished to show that the Company had since 1866 paid 10 per cent. per annum dividend. The price of gas now to citizens of Charlestown is $1.50 per 1,000 cubic feet. George R. Kelso, of the Charlestown Improvement Association, followed Mr. Babson. He contended that a reduction of price would greatly increase the consumption of gas, while the present rate prohibited its use extensively for heating or cooking. Nahum Chapin, a stockholder of the Company, knew something of the profits made by the Company and believed the price of gas in Charlestown should be less. George H. Gammans, President of the Charlestown Improvement Association, had no doubt that the price could be reduced without injury to the Company. Hon. Edwin L. Pilsbury said the price should be $1 or $1.25. Andrew Burns declared there would be a great increase in consumption if the price were reduced. John Dunigan believed it would be good business policy for the Company to reduce the price of gas in Charlestown to $1. Simon Davis, Counsel for the Company, argued at length in opposition to the proposition to reduce the price. The Company has made repeated reductions of price in the interest of consumers. He hoped the Commissioners would give the matter careful consideration. He believed they would do what was right. Mr. Babson, in behalf of the petitioners, argued at length in favor of the reduction of price. It should be placed somewhere between $1 and $1.30. Mr. Geo. B. Neal, Treasurer and Agent of the Campany, and Mr. James F. Hunnewell, President, made brief statements, and after a short statement by Mr. Davis, the hearing closed.

Cooking by Gas.

In the course of a very successful series of lectures on cooking by gas which Madam Alting-Mees has lately delivered in Brussels, at the invitation of the Belgian Association of Gas Managers, she took the opportunity of impressing upon her audience the great importance of a knowledge of cookery to all who are, or are likely to be, at the head of a household. When discoursing, whether in French or in English, on cooking by gas, Madam Alting-Mees shows that she not only understands her subject thoroughly, but also how to place it before her hearers in such an attractive way as to make them understand it. The attainment of this end is something to have achieved.

But this lady has higher aims than merely producing a number of excellent cooks with the aid of gas stoves and gaseous fuel. She would have women and girls—and more especially the latter—turn their attention *con amore* to the culinary art as a very powerful factor in the promotion of domestic comfort and happiness. If they have been reluctant to do so hitherto, because the conditions under which the operations in this department of household management have been performed have not been agreeable, such a feeling should not exist in these days, when, as Madame Alting-Mees and others have demonstrated over and over again, both the appliances used and the fuel employed in them conduce to rather than militate against the cleanliness which, as admitted by everybody, it is so highly essential to secure in preparing food for the table.

THE AMERICAN GAS LIGHT JOURNAL

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MONDAY, NOVEMBER 13, 1893.

The Market for Gas Securities.

The market for city gas shares was strong during the week, and that too in face of a sharp decline in the general share market. Consolidated opened to-day (Friday) at 135¼ to 136, and the demand on investment account was very prominent. We rather look for lower prices in city shares, however, because of the change in the complexion of the State legislature, which is Republican in both branches. Undoubtedly the reform element from the backwoods, which knows nothing about illuminating gas, will insist that the residents of our big cities are paying too much for their light, and, with the assistance of a few local cranks, they are likely to make trouble for the gas interests. It is true that Governor Flower, who has large investments in gas shares, has another year at Albany, and this fact is somewhat consoling, if not reassuring. Mutual gas sold up to 146, and 145 is freely bid for it. Equitable is also in demand, at 170 to 175. Chicago broke to 60, and opened to-day at 60¼ to 60⅜. At these figures it looks to be a purchase. Consolidated, of Baltimore, shows no change of moment, although it is about a half point off from our quotation of a week ago. Bay State and Laclede are sluggish. Respecting the Brooklyn situation, the least said the better, for the muddle over there looks hopeless.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 WALL ST., NEW YORK CITY.

NOVEMBER 13.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share. ☜

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	135½	135¾
Central	500,000	50	90	95
" Scrip	220,000	—	—	100
Equitable	4,000,000	100	170	175
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	108	112
Mutual	3,500,000	100	145	—
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	80	95
" Bonds	150,000	—	—	100
Richmond Co., S. I.	346,000	50	50	65
" Bonds	20,000	—	—	—
Standard Gas Co—				
Common Stock	5,000,000	100	—	32
Preferred	5,000,000	100	64	70
Yonkers		50	112	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	—	105
Citizens	1,200,000	20	50	55
" S. F. Bonds	320,000	1000	—	101
Equity Gas Light Co.	2,000,000	100	—	—
Bonds	1,000,000	—	25	40
Fulton Municipal	3,000,000	100	120	—
" Bonds	300,000		103	—
Peoples	1,000,000	10	—	75
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	98	100
Metropolitan	870,000	100	115	120
" Bonds (5's)	70,000	—	100	—
Nassau	1,000,000	25	140	—
" Ctfs	700,000	1000	99	100
Williamsburgh	1,000,000	50	125	—
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	75	—
2d " " "	3,000,000	1000	—	58
Bay State Gas Co.—				
Stock	5,000,000	50	16	16¼
Income Bonds	2,000,000	1000	40	—
Buffalo Mutual, N. Y.	750,000	100	110	—
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
Chicago Gas Company.	25,000,000	100	60¼	60⅜
Chicago Gas Light. & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	81⅛	81½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	101
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	108
2d "	2,500,000	1000	104	105
Consumers Gas Light Co., Jersey City	2,000,000	100	—	30
Bonds	600,000	1000	—	85
Cincinnati G. & C. Co.	7,000,000	100	192	—
Consumers Toronto	1,600,000	50	184½	187
Central, S. F., Cal.			—	100
Capital, Sacramento, Cal			—	55
Consolidated, Balt.	11,000,000	100	60	60¼
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	101
Bonds	250,000		—	—
Detroit Gas Co.—				
1st Mortgage			40	60
East River Gas Co., Long Island City	1,000,000	100	—	—
Bonds	500,000	100	86	87
Hartford, Conn	750,000	25	120	128
Jersey City	750,000	20	190	200
Laclede Gas Light Co., St. Louis, Mo.—				
Common Stock	7,500,000	100	17	18½
Preferred "	2,500,000	100	66	70
Bonds	9,034,400	1000	81⅞	82
Louisville, Ky	2,570,000	50	125	130
Little Falls N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Montreal, Canada	2,000,000	100	200	208
Memphis (Tenn.) Gas	750,000	100	30	—
" Bonds.	240,000	100	103	—
New Haven, Conn		25	200	—
Oakland, Cal.			42⅝	43
Peoples, Jersey City			160	170
" " Bonds.			—	—
Paterson, N. J.		25	99	102
Rochester, N. Y.		50	80	85
Preferred			90	95
Bonds			90	95
Syracuse, N. Y.	500,000	25	—	—
San Francisco Gas Co. San Francisco, Cal.	10,000,000	100	65½	66
Washington, D. C.	2,000,000	20	240	—
Wilmington, Del.	500,000	50	180	182

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GAS STOVES.

American Meter Co., New York and Philadelphia..... 703
The Goodwin Meter Co., Phila., Pa..... 684
George M. Clark & Co., Chicago, Ills.... 701
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SITUATION WANTED

As Superintendent of a Gas Works or Gas and Electric Combined,

by a pushing, energetic, sober young man of 30. Has had considerable experience in construction. Can give the best of references. Address

961-2 "E. H.," care this Journal.

Position Wanted

As Superintendent and Manager

of Gas Company having sendout of about 25 million cubic feet per annum. Water gas or coal gas. After December 1st.

958-5 Address "H. J ," care this Journal.

WANTED,

Position as Superintendent or Manager.

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Position Wanted

As Superintendent or Assistant Superintendent of Gas or Combined Gas and Electric Plant.

Fifteen years' experience. Best of references. Address

958-4 "H.," care this Journal.

Valuable Gas Interest For Sale,

The undersigned will sell, to the extent of $20,000 to $50,000, in sums to suit purchaser, an interest in a growing gas business now netting 8 per cent.; increase this year will give net earnings of over 12 per cent. Money wanted for extensions to cover valuable territory. A magnificent opening for a party desiring a permanent occupation and investment in one of the most pleasant residence locations in California. Banks and business firms as references. Address for particulars and statement,

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HYDRATED OXIDE OF IRON

For Gas Purification.

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Utilize Your Gas Liquor.
NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator.

Not Expensive. Write to
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Gas Governors, Governor Gas Burners, Gas Cocks and Fittings.

In addition to a full assortment of Volumetric Governors, etc., I am now making **MERCURY PRESSURE GOVERNORS** of all the usual sizes, adapted to use upon *Gas Stoves, Furnaces, and Meters.* The same careful attention to details of design and workmanship which has established the reputation of **WILDER'S VOLUMETRIC GOVERNORS** will be given to the new line. They have been thoroughly tested in many places during the past year, and have given entire satisfaction. The price is very low, and but for a complete system of machinery adapted to this work, it would be impossible to sell them at the price. I hope for large orders, as they become known, in consequence of the low price and good quality.

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LUDLOW VALVE MFG. CO.,

MANUFACTURERS OF

VALVES,

Double and Single Gate, ½ in. to 72 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, Oil and Ammonia.

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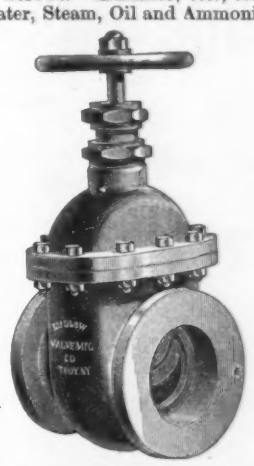

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Proof against Ammonia, and Absolutely Waterproof. Send for Prices and Particulars.

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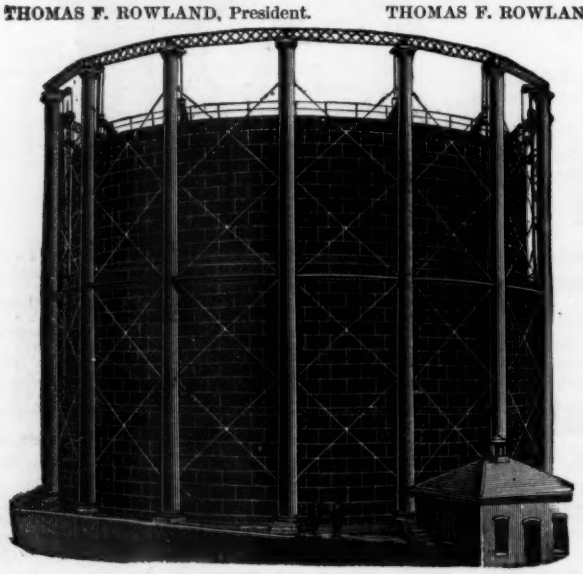

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Single and Multiple Section Gas Holders a Specialty.

Wrought Iron Gas Holder Tanks.

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For Round, Oval, or "D" Retorts.

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New Designs and

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For 1893-94.

Send for Catalog of the Most Artistic Line of Heaters on the Market.

The New Double Reflector is Worthy of Attention.

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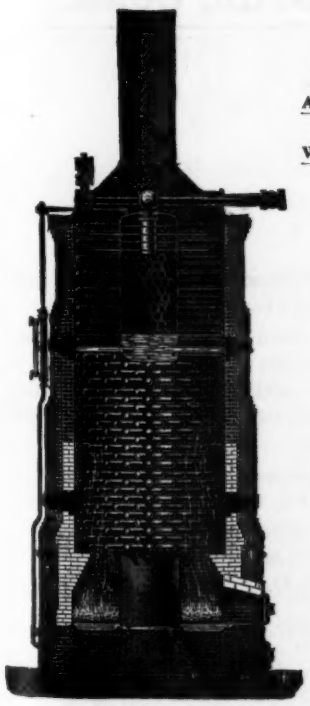
The HAZELTON BOILER Frequently Called The PORCUPINE BOILER

Patented in America and Abroad.



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We Solicit for it the Critical Examination of the Mechanical Profession and the Steam-Using Public.

THE HIGHEST STANDARD OF EXCELLENCE.

Standard Sizes, 50 H.P. to 500 H.P.

THREE REGISTERED
THE HAZELTON BOILER.

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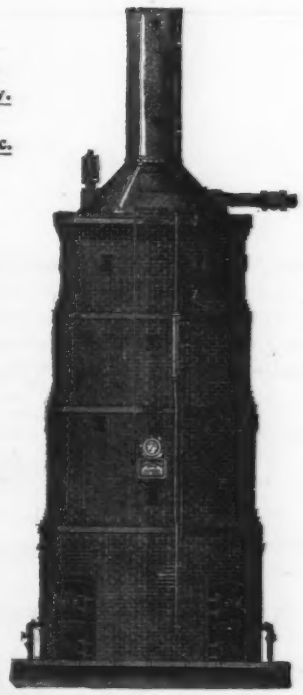
TRADE MARKS.

Special Sectional Boilers For Export.

The only Genuine Hazelton or Porcupine Boilers bear our Three Registered Trade Marks.

.·. BEWARE OF IMITATIONS. .·.

This Company is prepared to Manufacture and Furnish Plants of Boilers of any desired capacity, and will forward proposals and other information on application. All imitations of the substantial features of this Boiler are infringements, and will be prosecuted to the full extent of the law.



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Sole Proprietors and Manufacturers, NEW YORK, U. S. A.

Cable Address, "PAILA," NEW YORK. **WRITE FOR ILLUSTRATED CATALOGUE. Correspondence Solicited.** **Long Distance Telephone, 1229-18th St., New York.**

This Boiler is producing unequaled results in the works of most of the principal Gas Co.'s of the U.S., and in similar plants in Foreign Countries

NOT CONNECTED WITH ANY OTHER CONCERN IN THE UNITED STATES.

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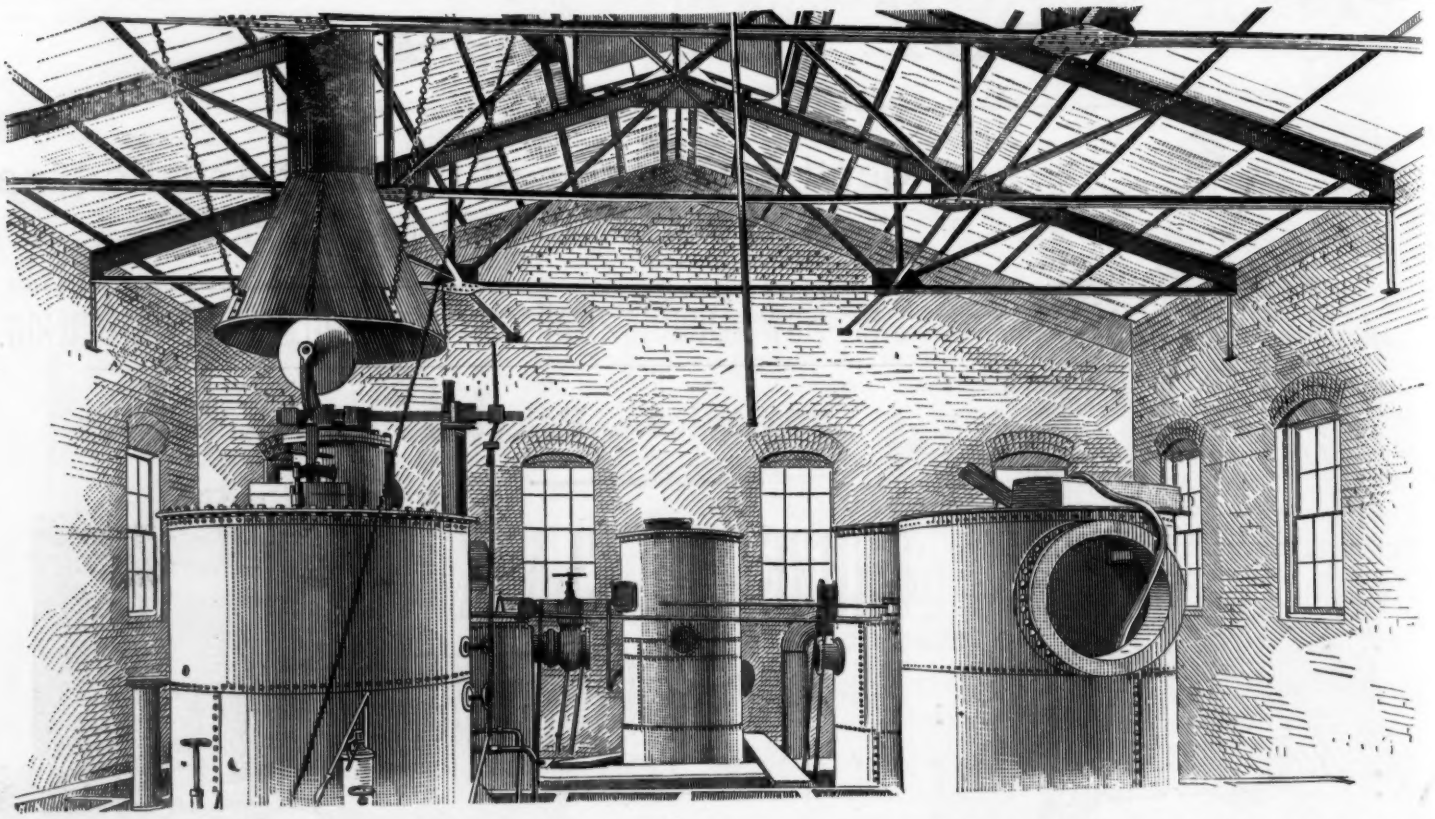
THE BERLIN IRON BRIDGE CO.



The above illustration is taken direct from a photograph, and shows the construction of an Iron Truss Roof designed and built by us for the Lynn Gas and Electric Company, at Lynn, Mass. The building is 37 feet in width by 64 feet in length, with brick side walls and an Iron Truss Roof covered with corrugated iron. A building of this kind cannot possibly take fire, as the interior appointments are such that there is little or no woodwork used about the construction of the plant, and no woodwork used about the side walls or roof.

Write for Illustrated Catalogue.

Office and Works, No. 6 Railroad Avenue, East Berlin, Conn.

HIGH CANDLE POWER

FROM

GAS.

MR. WALTON CLARK, Assistant General Superintendent, United Gas Improvement Co.:

Dear Sir—In accordance with your request, I have made several ests of the new Welsbach mantel (called No. 169) for candle power and efficiency, and I herewith submit the following results:

	Candle Power.	Pressure.	Gas Consumed.	C.P. per Cu. Ft.
Average of Test No. 1,	67.05	.95 in.	2.6	25.70
" " No. 2,	63.86	1.00 in.	2 86	22.30
" " No. 3,	72.50	2.1 in.	2.87	25.26

The above averages are the results of trials on three different occasions, and in each case the mantles tested were made from a different lot of fluid.

The mantles used in the above tests were selected at random, and all had been dipped in kristaline and dried ready for shipment.

It is quite possible that better results could have been obtained by manipulating and readjusting the position of the mantles on the galleries, and also by waiting a longer period after burning off the kristaline; but I considered such fine adjustment undesirable in determining the commercial candle power.

These tests were made on a bar photometer against a regular Edgerton standard slit. The candle power of the slit was 6.18, and the gas used was Gloucester City water gas, 26 candle power.

Very truly yours,
(Signed) C. H. PAGE, JR., M.E.

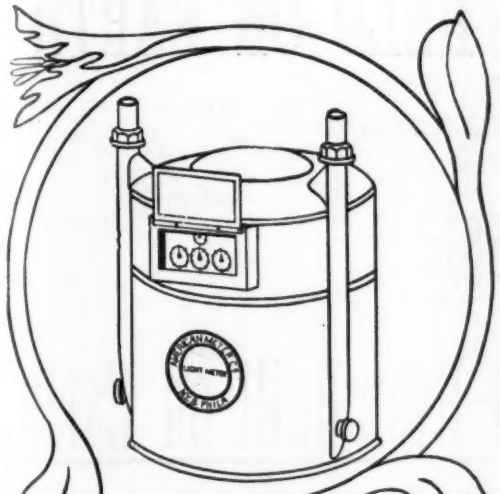
WE ARE NOW PREPARED TO FILL ALL ORDERS PROMPTLY FOR

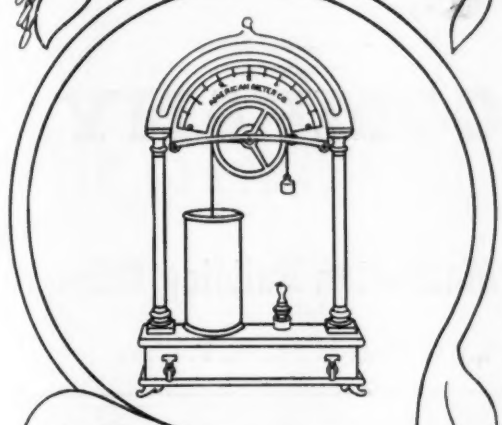
HIGH CANDLE POWER WELSBACH LIGHTS.

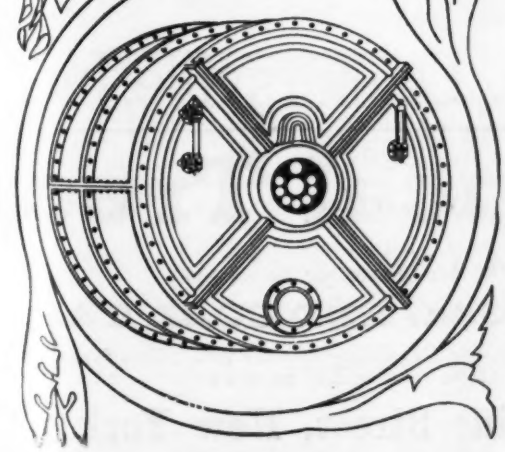
Gloucester, N. J. WELSBACH LIGHT CO.

NEWBIGGING'S HANDBOOK FOR GAS ENGINEERS AND MANAGERS.

The present (the fifth) edition marks an important advance on those that have gone before. Considerable additions have been made to the text and much of it has been rewritten and otherwise improved. Price, cloth, $6. A. M. CALLENDER & CO., 32 Pine St. N. Y







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ESTABLISHED 1834. INCORPORATED 1863.

NEW YORK and PHILADELPHIA.

CHICAGO, CINCINNATI,

ST. LOUIS, SAN FRANCISCO.

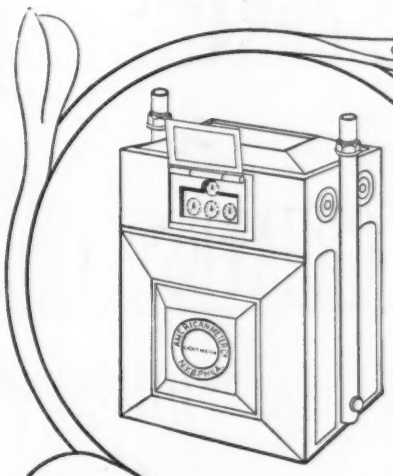
PUBLIC LIGHTING TABLE.

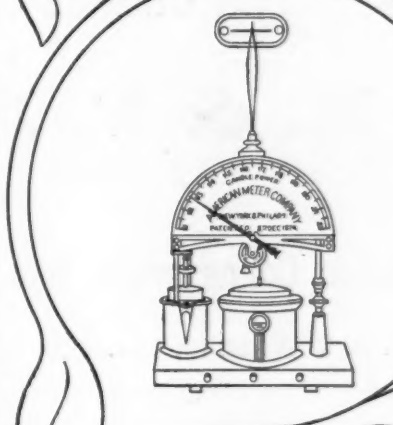
NOVEMBER, 1893.

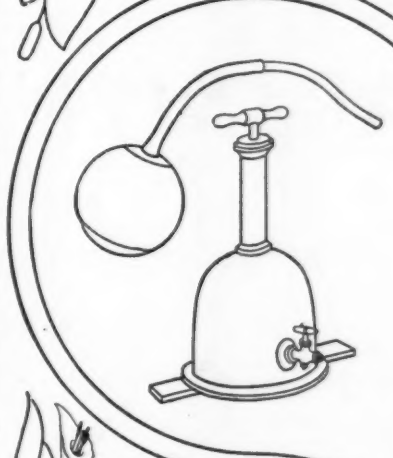
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Wed.	1	5.30 PM	1.10 AM	4.45	5.35
Thu.	2	5.30	2.20	4.45	5.35
Fri.	3	5.30	3.30	4.45	5.35
Sat.	4	5.20	4.30	4.45	5.35
Sun.	5	5.20	5.40	4.40	5.45
Mon.	6	5.20	5.40	4.40	5.45
Tue.	7	5.20	5.40	4.40	5.45
Wed.	8	5.20 NM	5.40	4.40	5.45
Thu.	9	5.20	5.40	4.40	5.45
Fri.	10	5.20	5.40	4.40	5.45
Sat.	11	5.20	5.40	4.40	5.45
Sun.	12	5.20	5.40	4.30	6.00
Mon.	13	7.30	5.40	4.30	6.00
Tue.	14	8.30	5.50	4.30	6.00
Wed.	15	9.30	5.50	4.30	6.00
Thu.	16	10.40 FQ	5.50	4.30	6.00
Fri.	17	11.40	5.50	4.30	6.00
Sat.	18	12.50 AM	5.50	4.30	6.00
Sun.	19	2.00	5.50	4.25	6.00
Mon.	20	3.10	5.50	4.25	6.00
Tue.	21	4.30	5.50	4.25	6.00
Wed.	22	No L	No L.	4.25	6.00
Thu.	23	No L FM	No L.	4.25	6.00
Fri.	24	No L	No L.	4.25	6.00
Sat.	25	5.10 PM	7.20 PM	4.25	6.00
Sun.	26	5.10	8.30	4.20	6.10
Mon.	27	5.10	9.50	4.20	6.10
Tue.	28	5.10	11.00	4.20	6.10
Wed.	29	5.10	12.10 AM	4.20	6.10
Thu.	30	5.10 LQ	1.20	4.20	6.10

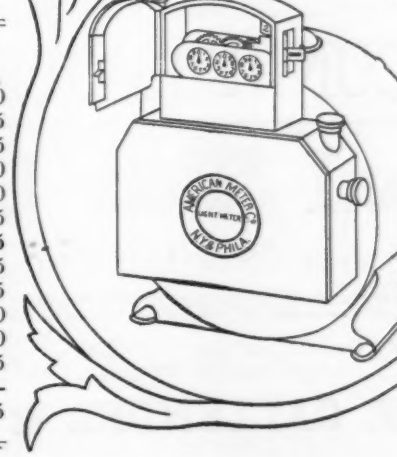
TOTAL HOURS LIGHTING DURING 1893.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January...	217.30	January...	423.20
February..	200.30	February..	355.25
March	177.50	March	355.35
April.....	160.30	April.....	298.50
May.....	149.00	May.....	264.50
June.	140.30	June.....	234.25
July	143.40	July.....	243.45
August....	154.50	August....	280.25
September.	171.50	September.	321.15
October....	202.20	October....	374.30
November.	221.30	November.	401.40
December.	248.50	December.	433.45
Total..	2188.50	Total..	3987.45









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NOW ON THE MARKET.

The attention of Gas Engineers and Manufacturers is respectfully invited to our new

CYCLOIDAL EXHAUSTER,

the internal operating parts of which consist of two Revolvers, each p'aned accurately on cycloidal lines, the only Exhauster so constructed.

SIMPLICITY * EFFICIENCY * DURABILITY.

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MR. T. VINER CLARKE, of London, Eng., having compiled a novel Chart or Map illustrating the various

CHEMICAL PRODUCTS DERIVED FROM COAL AND COAL TAR,

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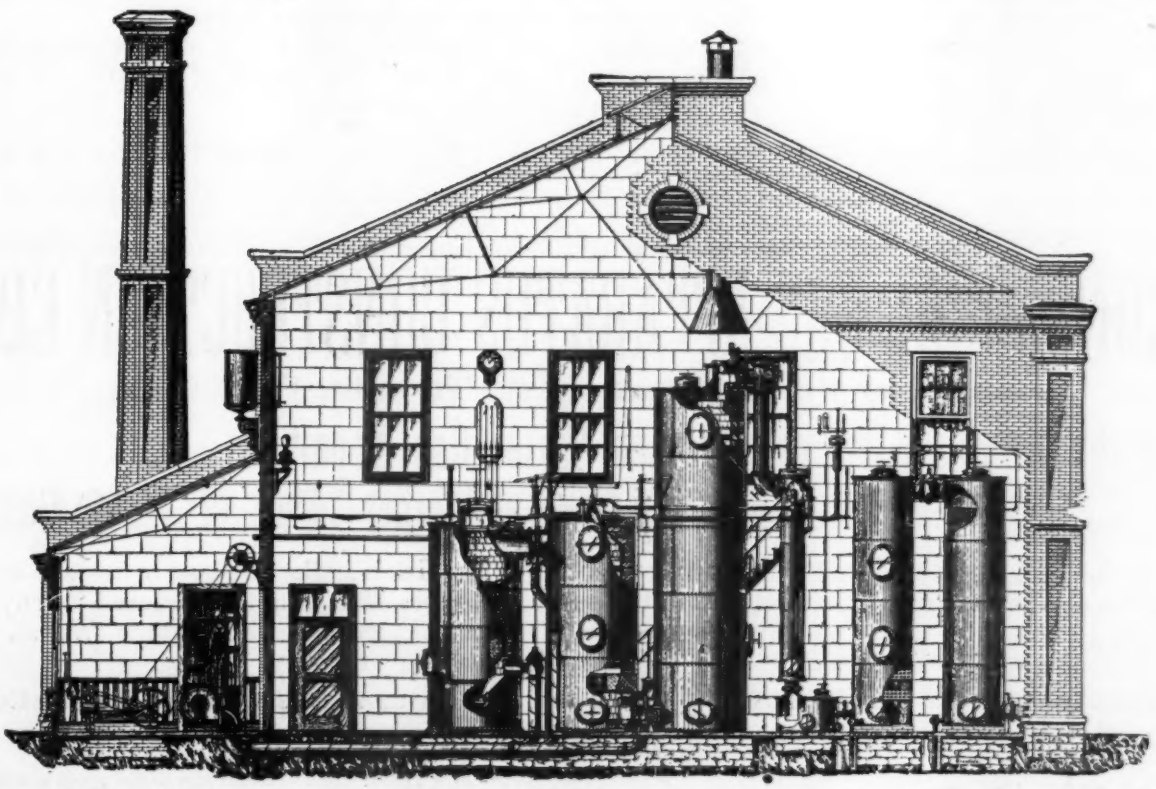
THE STANDARD LOWE WATER GAS APPARATUS.



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Water Gas Plants, either independent or auxiliary to Coal Gas Works, erected to meet any conditions. Apparatus designed to use any grade of Oil, and Anthracite Coal, or Gas House or Oven Coke.

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BY THE

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Our shop facilities are unexcelled, and enable us to quote prices which will prove interesting. The plants in operation demonstrate we have the **Experience** necessary to build Water Gas Apparatus on **Scientific** as well as **Practical** principles, and consequently **Build them Well.** Hence we don't hesitate to **Guarantee the Results.** We not only believe in "Water Gas on its merits," but also in building the apparatus at a price that will not only prove it a desirable investment as to the first cost, but produce results that will put the balance on the right side of your ledger.

There are three essential features in our design which we carefully considered as **Absolute Requirements:**

Durability, neatness, and compactness of the machine.

Minimum labor requirements for operation, and

Minimum amount of material required for results.

And when we add to this a minimum cost of a **Strictly First-Class Apparatus,** can you afford to be without it? If not, write us, and we shall take pleasure in proving our statements to be facts.

Also remember we are not exclusively building Water Gas Apparatus, but if you require **Any Apparatus** for **Coal or Water Gas** and want the latest and best designs, write us for prices, or we will execute carefully your own designs if desired, as we believe in giving you exactly what you want.

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For Continuous Records of

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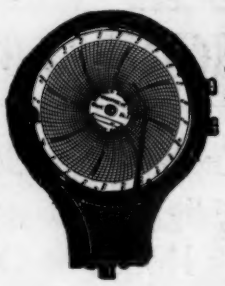

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CHURCH'S TRAYS a Specialty.

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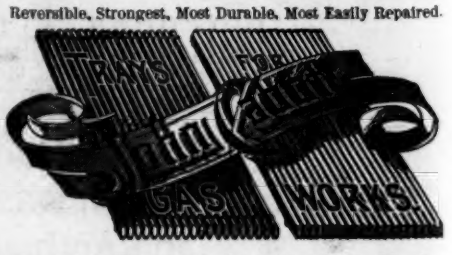

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SOLE OWNERS OF THE REW SOFT COAL CARBURETED WATER GAS APPARATUS.

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"IRON SPONGE." Saves money, saves labor, and is the most efficient purifying material ever offered as a substitute for lime. We guarantee a large saving, both in cost of material and labor.

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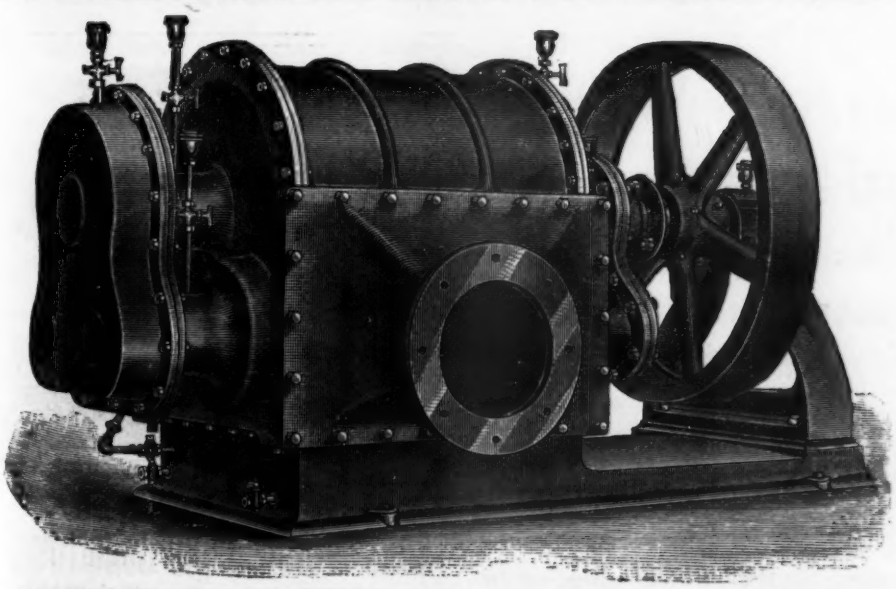

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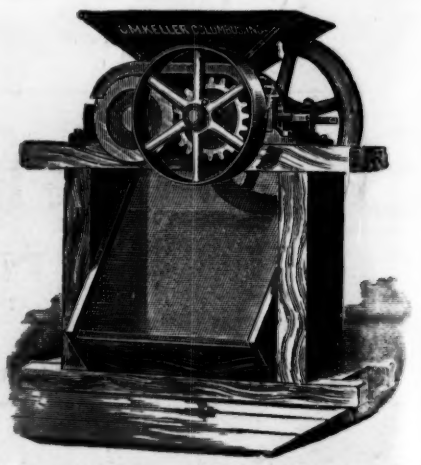

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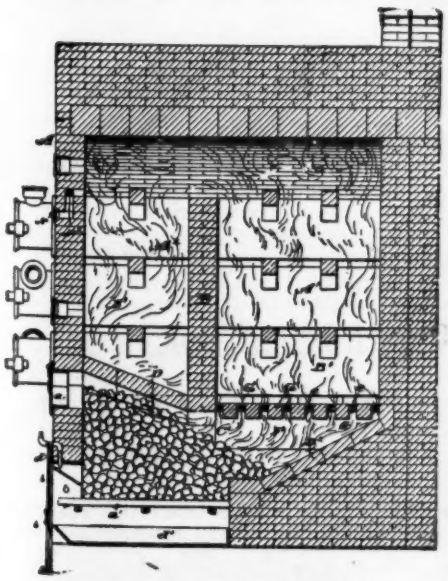

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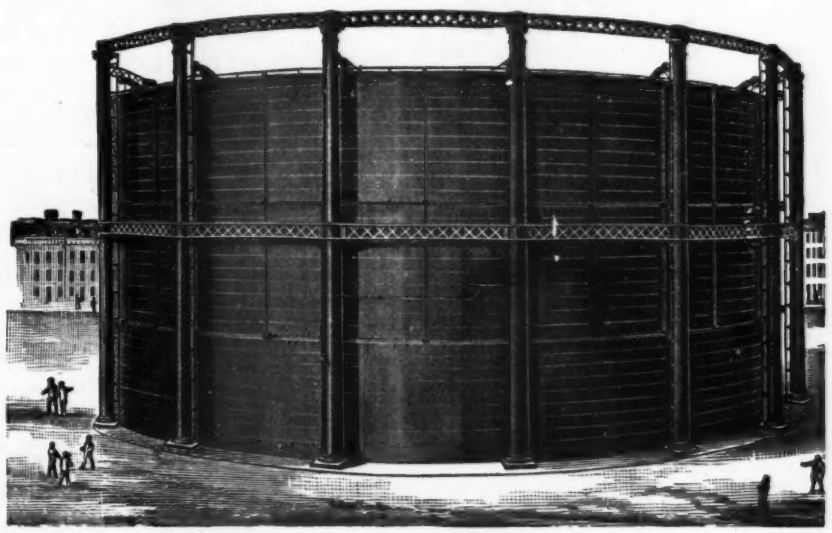

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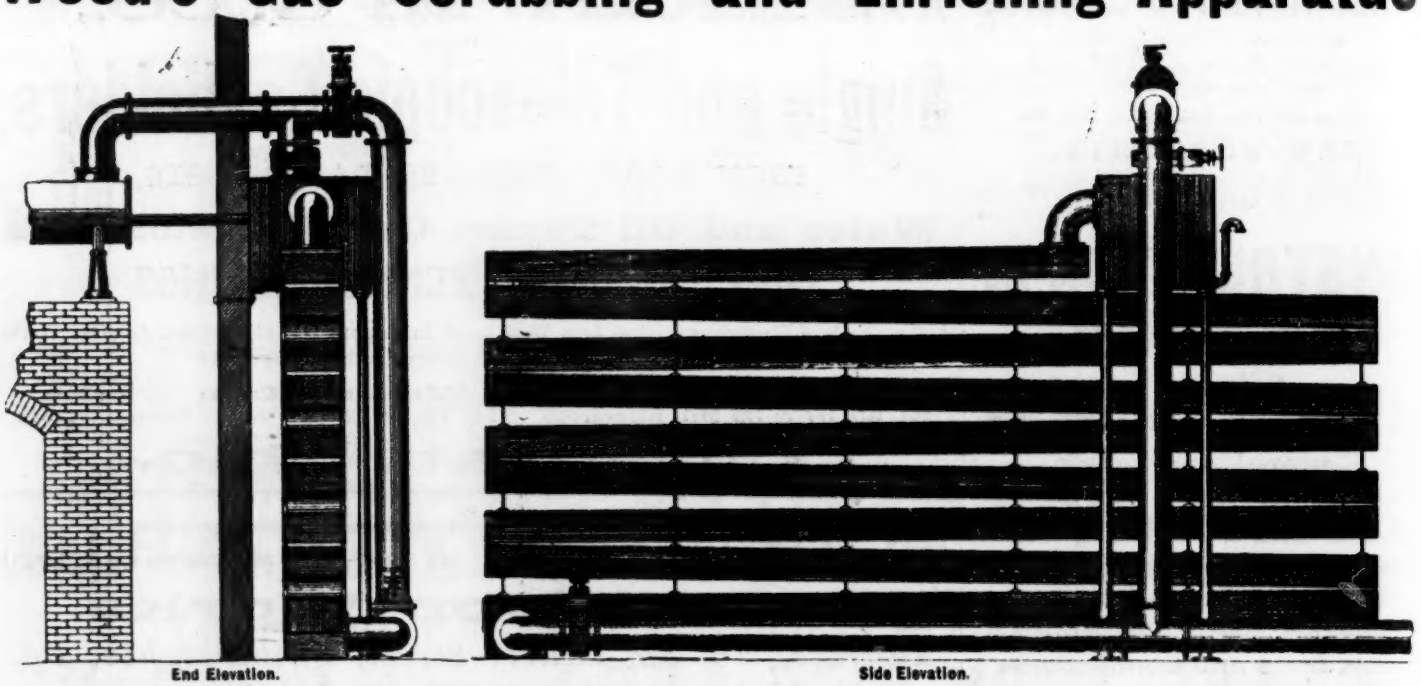

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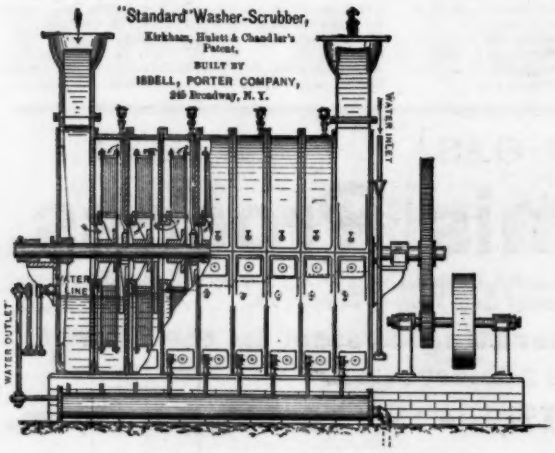

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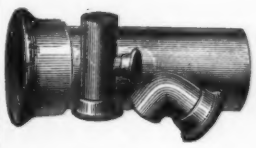

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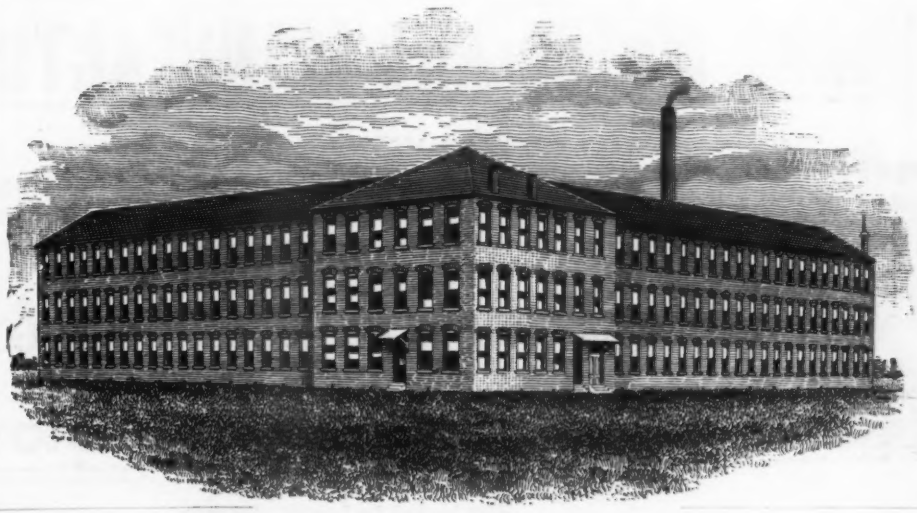

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